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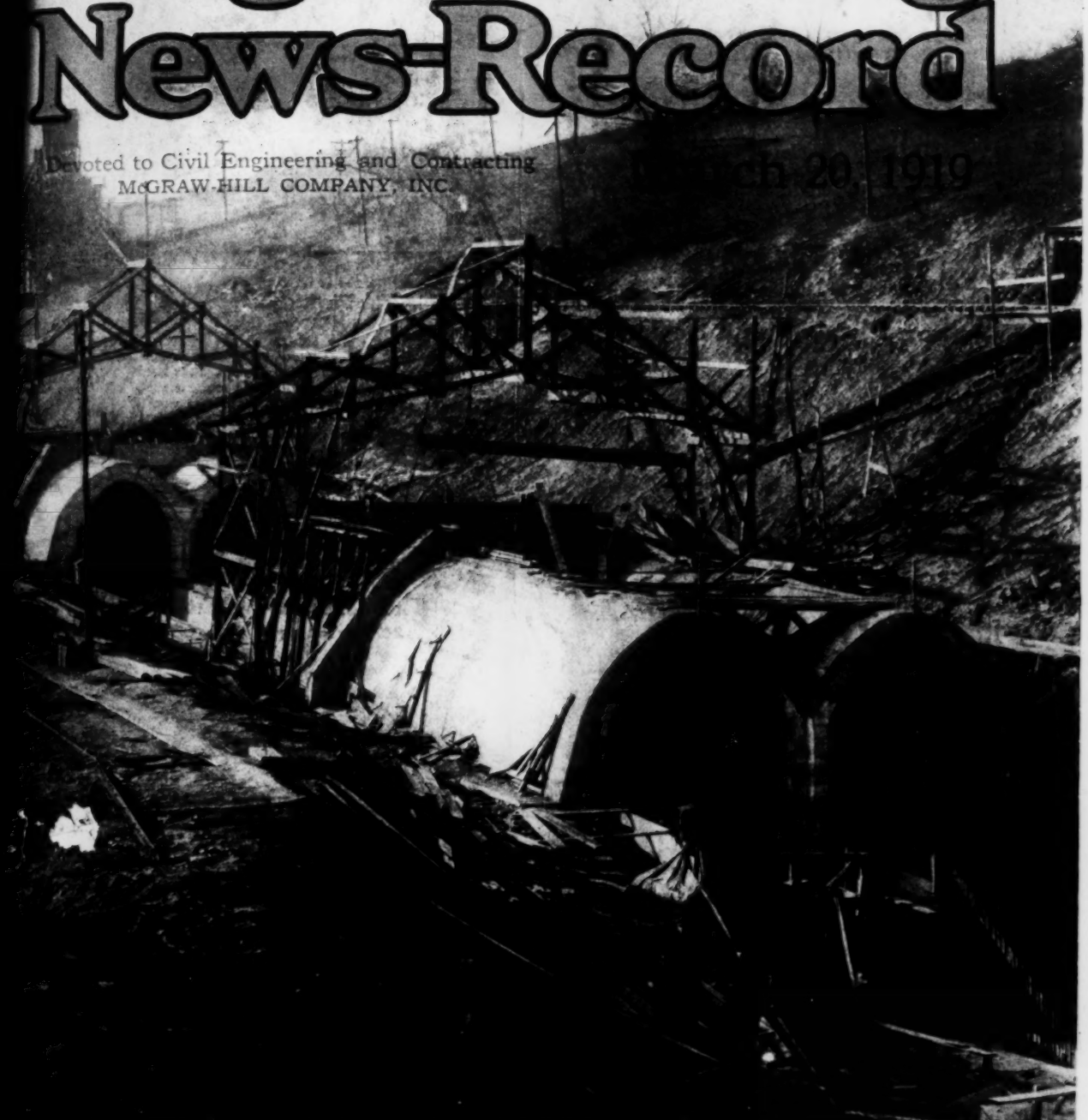

Plant for Building Fabricated Ships at Bristol

Keep Accurate Costs on Fee Contract

By Farley Gannett and J. D. Carpenter

Salt-Marsh Sand-Clay as Road-Building Material

Good Yard Layout Speeds Up Floating Dry Dock Construction

Travelers Shift Forms and Chutes in Concreting Outlet Conduits for Germantown Dam

KREOLITE LUG WOOD BLOCKS

"The Paving that's Saving"

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KREOLITE LUG WOOD BLOCKS
"The Paving that's Saving"

Volume 82 March 20, 1919 Number 12

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

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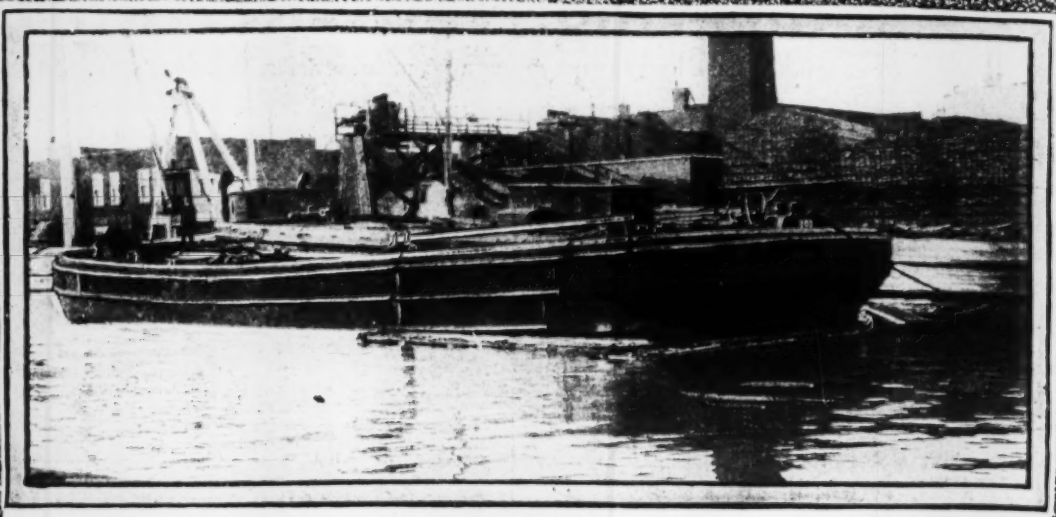

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, Editor — CHARLES WHITING BAKER, Consulting Editor

Volume 82 — NEW YORK, THURSDAY, MARCH 20, 1919 — Number 12

Meeting the Cost of Water-Main Extensions

HOW best to meet the cost of extending water mains is not so easy a question to answer as may appear at first thought. Practice varies widely and does not seem to be based on comprehensive scientific study. The path of least resistance is the one most likely to be followed. Beyond attempts to avoid legal pitfalls, local feeling seems to control. The policy of the water board or city council may be liberal or the reverse, according to whether there prevails the idea of water service to all on easy terms, or strict regard for revenue in excess of capital and operating charges. Or the practice may range between these two extremes. The variations thus far considered relate to the division of responsibility for extensions between individuals and the city. Where the individual property owners must bear the whole or part of the responsibility there still remains the question: Shall they pay the first cost of the extension, or shall they guarantee a revenue for water which shall be a stated percentage of the first cost? If the property owners pay all or part of the first cost, how shall it be apportioned among them? The easiest way is to adopt the pro rata frontage basis. Is it the fairest and best way? If the property owners voluntarily and unanimously agree to such a plan, perhaps no one need complain, but if the city must use compulsion on some property owners then the question arises, Is the plan equitable? The subject bristles with questions.

Assessment of Benefits Deserves More Attention

INCREASED attention might well be given to assessments for benefits, as a means of meeting the cost of water-main extensions. This proposition was brought before the New England Water-Works Association at Boston last week. The discussion, briefly summarized on p. 591, was quite extended, but it ranged over the broader field of paying for water-main extensions discussed in the note preceding this one, and showed the diversity of practice already mentioned. The discussion indicated that the practice of making individuals assume responsibility for water-main extensions is common, and that often it is the property owner rather than the water consumer who must shoulder the burden. The examples cited did not show that an out-and-out benefit plan is commonly used, but, rather, that where the property owners are made responsible frontage is the basis of dividing first cost. More commonly, it appeared, there is a voluntary assumption of responsibility, whether on a first-cost or a revenue-guarantee basis. The discussion, common observation and any considerable knowledge of human nature, combine to show that such a plan leads to unfairness. Sooner or later, those who assume none of the responsibility get water without bearing their share of the burden. Taking all the foregoing facts and opinions into account, as well as the increasing difficulty in finding money for municipal improvements, the case seems to be strong for a thoroughgoing study designed to show for a considerable number of water-works, well distributed geographically, what the current practice is as to meeting the cost of water-main extensions, the details of the assessment-for-benefits plan whenever it is used, and the wisdom of extending that plan. The study should include consideration of how the benefits-assessment plan may best be adapted to water-works conditions.

Lessons From Spring Breakups

TIMES of excessive moisture are generally admitted to be the most critical periods in the life of road surfacings. This was abundantly proved by the experiences of last spring, when large sections of roadway which had successfully carried equal or greater traffic over dry subgrades were broken through as the frost left the ground. As excessive moisture is the recognized cause of these failures, the least that can be done at such times is to keep the ditches open so that the saturation of the subgrade will not be increased by standing water. A second precaution which might well be employed is to regulate heavy traffic at the critical time. If roads which will carry the loads for 360 days in the year are broken down by the traffic in the other five, as was the case in some instances last spring, it would seem the height of maladministration to allow the same thing to occur again. While in many sections there is little depth of frost this year, due to the clemency of the past winter, there is certain to be a season of excessive moisture, and every effort should be put forth by highway officials during the next two months to safeguard the public investment.

Highway Lettings Should Be Expedited

EVIDENCE of delay in the authorization of projects and the preparation of plans for country highway and city paving is making its annual appearance. Although March is nearly gone and plans should be ready for the spring opening, little work is being advertised for letting. Much of this delay is no doubt due to the hope among officials that there will be a decline in the prices of highway materials. This is a mistaken policy, both because investigations by economists indicate no immediate prospect of such a movement, and because the monetary value to the communities of immediate use

of good roads would largely counterbalance any possible saving in the cost of road materials. The disadvantage of a late start in highway work is apparent to all engineers. It means late fall work, under frost conditions, and possibly a shut-down for the winter months, thus delaying the completion of the contract and the utilization by the public of the money already invested. To these arguments against delay may be added the patriotic incentive to help out in the unemployment situation confronting the nation. The road-building season is short at the best, and highway engineers should urge their commissioners, councils and boards of public works to expedite the lettings.

Some Mayors Need Education

IN THE last minutes of the recent Governors' and mayors' conference in Washington the presiding officer read a resolution signed by a number of the 130-odd mayors present. It set forth that whereas a number of cities are interested in the purity of their water supplies, etc., etc., therefore be it resolved that Surgeon General Rupert Blue of the United States Public Health Service be requested to investigate the many systems of sewage purification—it may have read "sewerage" purification—and, as a result of this investigation, recommend the best system to use. This was the purport of the text; the exact words are not available, and it was not only signed, but advocated on the floor, by several of the distinguished heads of cities. This is not a joke, but a veritable occurrence. Engineers who are inclined to laugh at it should rather bestir themselves in their towns. Dissemination of the facts underlying great engineering operations or principles is apparently needed in many quarters.

No Military Control of Public Works

ALTHOUGH lost sight of in the confusion of the last days of the 65th Congress, the idea of a Federal Department of Public Works must not be allowed to die. Now is the accepted time for this most necessary change in the control of Government engineering operations, when Congress, through repeated appropriations, is alive to the extent of those operations, and, what is more important, to their divided control. Individuals must urge the Public Works Department idea; engineering societies must push it, but everyone should insist on a subordination of the military in this civilian department. Particularly will it be necessary to combat the idea that engineer officers of the Army must take charge of civil engineering works of the Government in order to provide them with the practical engineering experience necessary in war.

Granted that the Army's own work—barracks, fortifications, etc.—will not be sufficient to ground the Army engineer in the fundamentals of the construction and administration end of his profession, there is no reason why the engineer officer cannot be *assigned* to the civilian operations under the direction of a Department of Public Works, as has been done for many years in the British colonies. Let the Army engineer spend the proper amount of time in the Army organization—commanding men, studying and developing purely military engineering, building the structures and equipment necessary to the Army itself—and every so often let each officer be detached from his unit and assigned, as a civilian, with only a civilian's privileges and rights, to one of the multitude of engineering constructions that a proper Federal Department of Public Works would control. He could not thus carry over the asperity sometimes peculiar to the military uniform. That uniform would not bar the way of his subordinates to promotion. He would be, for the time being, a civil engineer in a civilian organization, learning many things of value to him in his profession of military engineer, and giving to the Government and to the job the benefit of his education and his experience.

A most powerful influence to bring about such a development will be found in the thousands of discharged soldiers. The Army, to these men, while a most necessary thing to have ready for war, demands a routine and a régime not at all fitted for the less rigorous operations of peace. They will insist, especially the engineers among them, that the Army stick to its military functions and leave Government civil construction to the less rigid and more democratic control of a peace-time civilian organization.

Plan to Eliminate Jurisdictional Strikes

EMPLOYERS and employed have taken an important step toward cementing the building trades into a league for the settlement of disputes as to union jurisdiction over work. The immediate purpose of the league, or board, as it is called, is to create a means for preventing strikes of building trades unions due to jurisdictional arguments.

Some months ago, at the separate but simultaneous instance of the American Institute of Architects and the Building Trades Department of the American Federation of Labor, the United States Department of Labor undertook to canvass the situation and suggest a working plan. After various conferences with labor leaders and representatives of the American Institute of Architects, a formal plan was drafted by John A. Lennon, and on Mar. 3 and 4, at Cleveland, Ohio, this plan was submitted for action to representatives of the building industry.

The plan submitted called for the creation of a body to be known as the National Board of Jurisdictional Awards of the Building Industry, to consist of eight members and eight alternates, four to be selected by the Building Trades of the National Federation of Labor and one each by the American Institute of Architects, the American Society of Civil Engineers, the Associated General Contractors of America and the National Association of Builders' Exchanges. The duties of the board are to hear and determine claims for jurisdiction over work performed, and make award in conformity with the facts. A three-fourths majority vote of the full board is required to fix the award, and it is provided that all local arbitration committees shall insert in the agreement between employers and employees a clause as follows: "The decisions of the National Board of Jurisdictional Awards of the Building Industry shall be final and binding upon the parties to this agreement."

Engineers, contractors and union labor have thus demonstrated their capacity for coöperative action for mutual benefit. This is an attainment which looks far beyond the immediate object sought. It promises, ultimately, a real partnership of management and labor in the construction industry.

Will Prices Fall?

WILL PRICES FALL, is the national question of the day. Upon its answer depends to a large extent the business activity of the near future, and upon that business activity in turn depend social questions of tremendous import. From time to time *Engineering News-Record* has commented upon the situation, the sum total of that comment being that prices are not likely to fall to any material extent in the near future. This conclusion has been predicated upon the belief that the total of the peace-time demand will not be far short of the war demand itself. During the war there was produced a tremendous shortage in practically every kind of commodity. There is an oversupply here and there, but the instances are isolated and entirely out of harmony with the general situation. That shortage must inevitably be overcome unless the peoples of this world lower materially their standards of living. History and the disposition of the public in every country of the globe give us the assurance that living standards will not be lowered. In fact, they are quite likely to be raised, still further increasing the post-war demand and assuring that it will be not much below that of the maximum war demand itself.

Reinforcing this point of view is the testimony of the periods following the Napoleonic and Civil Wars, graphed and discussed by Morris Knowles in *Engineering News-Record* of Feb. 27, 1919, p. 414.

Now Irving Fisher, professor of political economy in Yale University, approaching the problem from an entirely different standpoint, draws the same conclusion.

He takes the position that the world has advanced to a new price level, and that this new price level is no more likely to be receded from than were the price levels brought about by the great influx of gold and silver into Europe from the mines of the new world in the sixteenth century, or that caused between 1896 and 1914 by the discovery of the gold fields of South Africa, Cripple Creek and Alaska, the invention of the cyanide process in mining, and the vast extension in the use of bank credits. In other words, he sees in the present price advance, even though brought about by the urgency of war, a permanent change in the plane on which the world must do business.

Explaining his position, Professor Fisher adverts to the well known and thoroughly established fact that the general level of prices is dependent upon the volume and rapidity of turnover of the circulating medium in relation to the business to be transacted thereby. As he puts it, "If the number of dollars circulated by cash and by check double, while the number of goods and services exchanged thereby remains constant, prices will about double. Over $1,000,000,000 in gold has come into this country from abroad since 1914, and a large amount has disappeared from domestic circulation. On June 30, 1918, the portion of the gold reserve of the Federal Reserve banking system which supported national bank deposits and Federal Reserve notes was more than three times as large as the gold reserve under the old national banking system on June 30, 1914—$1,786,000,000, as compared with $592,000,000. During the same period, credit instruments (demand deposits and notes) increased about twofold—from $6,100,000,000 to $11,700,000,000. It is this increase of credit instruments, typical of the banking situation for the country as a whole, which, Professor Fisher points out, largely explains the present high level of prices.

Moreover, we are not at the end of the possible limit of expansion even now, provided we take the same view of our financial structure, or at least of the ratio between credit and gold, as we did in the pre-war period. At the present time the ratio of gold to credit has risen from 9.6% to 15.3%, while the reserve requirements of the present system are such that for 1918 there was an excess of gold above legal requirements of more than $700,000,000. The reserve required by law to support the $11,700,000,000 of credit instruments of 1918 is $1,070,000,000. The $700,000,000 of free gold could support an additional superstructure 70% as large as the existing one, which indicates that for the banking of the country as a whole a potential future expansion of 50% is a conservative estimate.

Discussing the situation from the standpoint of so-called "inflation," Professor Fisher points out that by inflation we mean merely the use of more circulating medium than is needed to transact the business of the country on a given price level. Whether or not we have inflation, therefore, depends upon the price level. If the price level of 1913-14 be considered normal, there would certainly be inflation now, but our currency is not inflated at the present time relative to the new level of prices in the world which the war has brought about. In other words, any expectation that there will shortly be a disappearance of this so-called "inflation" is based on the assumption that normal prices are those of 1914.

Looking to the future, there is no hope in sight for credit contraction; another large Government bond flotation is at hand, with the possibility of still another. After that there should be some contraction in the volume of credit, but Liberty and Victory bonds then in the hands of the people will be unrivaled bases of credit, and, experience shows, will undoubtedly be used for that purpose, thus tending to keep up the outstanding credit volume. He does not contend that it is absolutely impossible to bring down the price level, but argues that the experience of history and the possibilities now open for world-wide expansion point to the maintenance of present prices permanently or at least for a long period of years. Between the period of temporary and of permanent effects there may be a slight dip in the price level, say a year from now, but the possibility of that, he holds, is all the more reason why business should proceed now and not wait a year for the dip.

The conclusion to be drawn from this situation is that the sooner the business men of the country take the view that we are on a permanently higher price level and adjust themselves to it, the sooner will we save ourselves and the nation from the misfortunes that will come if we persist in our present false hope of expecting prices to come down, meanwhile creating a dangerous unemployment situation. Since the armistice, the buyers of the country have made an unexampled attack upon prices through their waiting attitude, and yet price recessions have been insignificant.

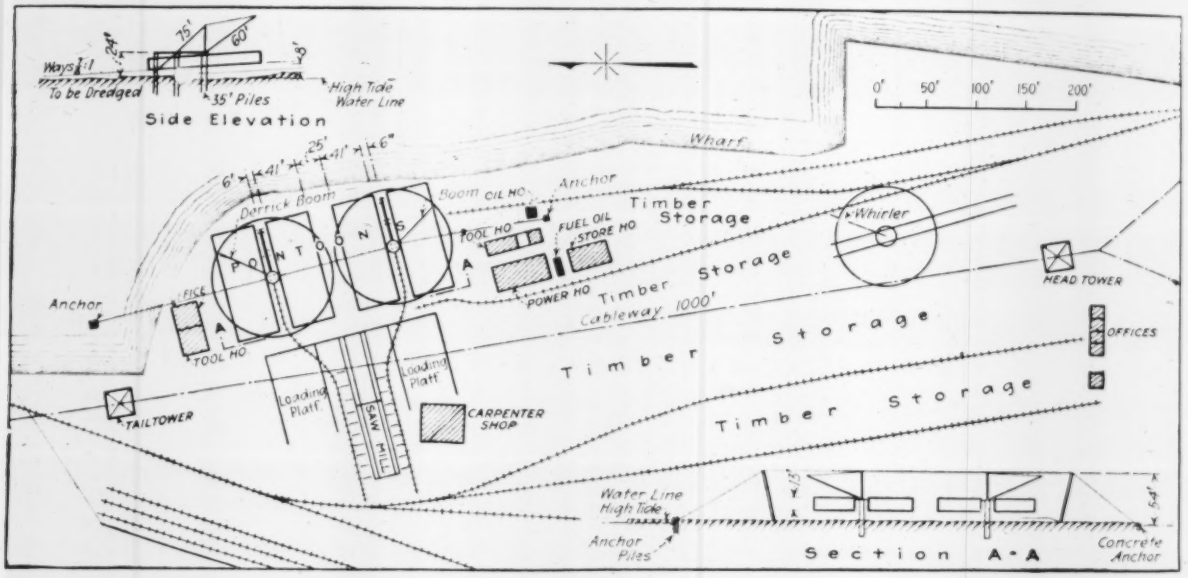
The clever man, Professor Fisher concludes, "is not the man who waits, but the one who finds out the new price facts and acts accordingly." What applies to the business man applies to Government officials, local, state and national, who hold a greater responsibility just now than the individual business man, for in their keeping rests national stability. If they will proceed with public works, the mills and the mines will operate, the whole industrial fabric will be strengthened, and the ominous prospects of business depression will disappear.

Building a Floating Dry Dock in Well Laid Out Yard

Cableway Assisted by Whirler and Derrick Car Keeps Heavy Timbers Ready for Carpenter Crews—Large Band Saws and Cutoffs Frame 12 x 12's Handled on Two-Way Roller System

MATERIAL for the 10,000-ton floating dry dock now under construction at Galveston, Tex., for the Galveston Dry Dock and Construction Co., moves through the yard with order and precision. To this fact and to the layout of the yard which permits this ready hauling of material, is attributed much of the speed and efficiency with which the work is being carried out. The dry dock consists of 11 wooden pontoons each 41 x 110 ft. in plan and 13 ft. high which are built on four parallel ways and launched endwise, to be tied together afterward by the plate-covered steel frames which form the dry-dock wings.

The ground selected for the construction of the pontoons, as shown in the drawing, afforded two railroad connections and a wharf. A cableway was laid out along the length of the lot between the railway tracks, forming the heart of the material transportation system on the job. At one end of the yard a whirler derrick on a 12-ft. track was set up between the cableway and the railway siding, and is used to unload material directly to skids under the cableway. The sawmill was placed at the other end of the lot between the other track and the cableway at a point opposite the four ways. A derrick car unloaded onto the storage skids and platforms near the mill that part of the material which required framing. Other material was unloaded at the other end of the yard directly under the cableway. The storage piles were so laid out that the longest timbers required could pass between them while going from the mill to the derricks on the standard-gage four-wheel cars of the feeder tracks. Each track fed one derrick. As the tracks passed under the cable-



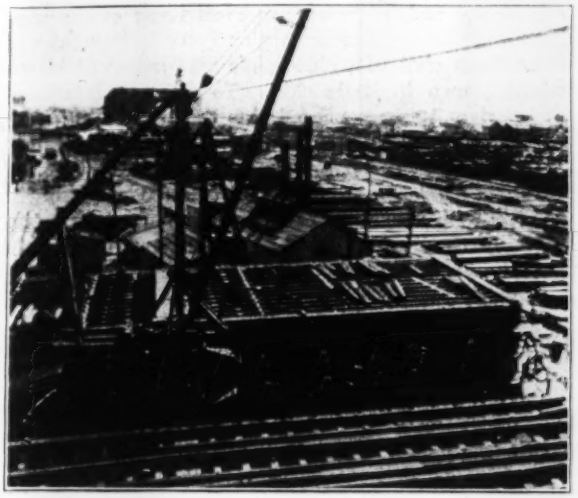
LAYOUT OF YARD WHERE FLOATING DRY DOCK IS BEING BUILT AT GALVESTON

PANORAMA FROM CABLEWAY TOWER AT END OF YARD USED FOR BUILDING PONTOON UNITS FOR A FLOATING DRY DOCK FOR GALVESTON, DRY DOCK AND CONSTRUCTION COMPANY

way the cars also received material for the derricks from the cableway.

The mill itself is composed of two units, although under one roof, run by one engine and fed by a derrick car and cableway. Each unit consisted of a 36-in. band saw and a cutoff, one 36 and the other 42 in., and a roller conveying system from the storage piles. One joiner and one rip-saw served both sides, and one engine drove the two lines of shafting which took care of all equipment. Each side of the mill supplied the derrick nearest it.

Large saws were used, as the timber to be cut was all of large dimensions. The swinging cutoffs were found very useful in squaring ends and cutting lengths, while the band-saws were used for bevel work where the weight of the piece to be cut would permit maneuvering at all readily. Extremely heavy pieces were cut with a pit-saw by hand. A box templet was used to get a true cut, and the timber was placed on a platform to eliminate the necessity of a pit.



THIS DERRICK WAS ABLE TO BUILD TWO PONTOONS SIMULTANEOUSLY, EACH 41 x 110 FEET

The platforms adjoining the mill were built of timbers bought for the pontoons and used in them at the end of the work. As pieces requiring but little framing were selected, there was little mill work left to be done after the platforms were torn up. The ground blocks and the struts which sat on them were the only timbers bought for the platforms.

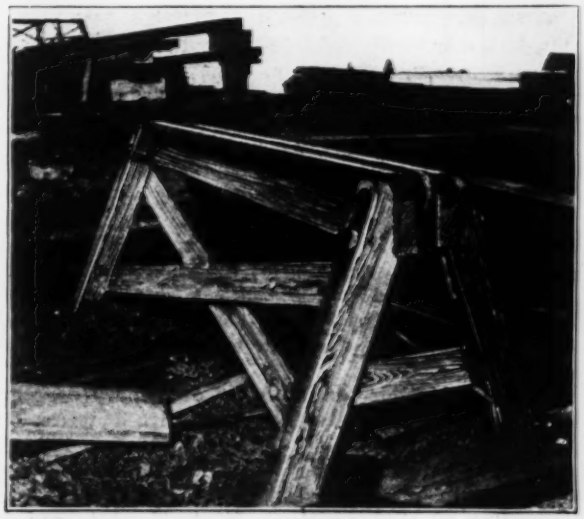
To facilitate easy handling, the tops of the mill platforms, skids and rollerways were made level with the tops of the saw tables. Rollerways on both sides, running close to the cutoff, led from the end of the platform by the switch to the end of the pontoon ways. On the switch side two more rollerways were placed beside the one toward the center of the mill. Outside were 8-ft. horses built with cast-iron rollers projecting from their tops, for the purpose of conveying timbers in a direction across the length of the piece. These rollers overlapped each other in plan, so that an 8-in. piece would always be on two of them and not edge between the rollers and the stick. The idea of these rollers was obtained from work of the Midland Bridge Co. in Houston.

ROLLERS THAT HANDLE HEAVY TIMBER AT SAWMILL

Timber was stored in a long pile under the cableway and in several piles around the mill. The cableway pile held the material for six pontoons when piled to a height of nine feet.

The skids away from the mill were only built high enough to keep the timber off the ground and to allow a chain to be passed readily underneath.

Another point that made for smooth, quick work was the fact that the derricks at the ways were raised high above the pontoons. The engine runners could see directly and at close hand the placing of almost every piece they handled. Free motion of the boom is afforded by this elevation, as well as by the use of a single stiffleg and an overhead guy. One cable runs over the top of the two derricks and on over two masts, one at each end, placed clear outside of the area occupied by the pontoons. The ends of this cable are anchored after passing these outside masts. The stiffleg on each derrick secures the mast in two directions, and the guy

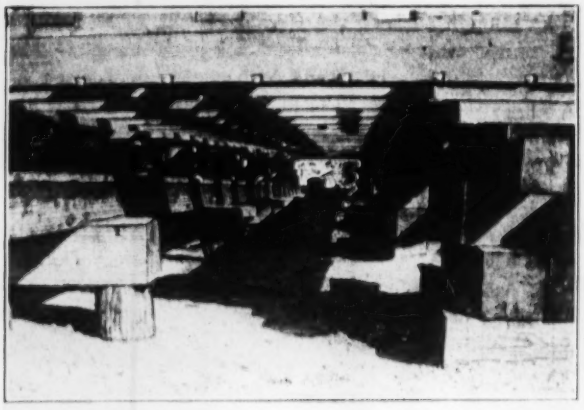


A HEAVY TIMBER LAID ON SEVERAL OF THESE ROLLER HORSES PLACED SIDE BY SIDE IS EASILY MOVED

over the top holds it in the two opposite directions, thus securing the derrick.

Support of the pontoons during construction was provided at the ways by piles of blocking topped by 8 x 12-in. wedges, as shown in one view. The flooring on the bottom of the pontoon was then placed, and the sliding ways were set and blocked against the bottom of the finished pontoon. The fixed ways were built of 9 x 9-in. timbers bolted together to form a 9 x 18-in. piece with staggered joints. This was laid flat on the supporting pile caps. With the blocking snugly set between the ways and the pontoon, the weight of the latter was delivered to the former by loosening the wedges on top of the blocking upon which the pontoons had been built. In one or two cases it was necessary to dig under these blocks and allow them to settle, but usually the wedges themselves moved readily enough. The upper or sliding ways were flanged instead of the lower or fixed ones, which required less flange material, as the upper ways were the shorter.

After it was launched, but before it was towed to the assembly slip, each pontoon was loaded with steel for the wings. These wings are water-tight steel walls which are continuous over the several pontoons, and so assemble them into a unit, the finished dry dock. A joint is made in the wings, however, so that the 10,000-



DETAIL OF BLOCKING AND WAYS

ton dock may be divided into two units, using four and seven pontoons, respectively. The framework of the wings is erected by a derrick barge which also handled the outside plates. The inside plates are raised by a hoisting engine using a line through a block fastened to the top of the framework. A permanent compressor plant was outfitted early so as to supply air for driving the 300,000 rivets used in the wings.

In order to hold the pontoons firmly in the correct position during the placing of the wings, four wooden trusses are bolted to the pontoons, holding the two pontoons being attached to those already assembled. When new pontoons are to be attached the trusses are moved ahead.

The construction and assembly of the dry dock are being done by a Missouri Valley Bridge and Iron Co. organization headed by F. E. Washburn as engineer in charge. C. W. Cubbage is superintendent on the work in the pontoon-building yard, and F. L. Brock is superintendent of steel erection. H. A. Treat is general manager of the Galveston Dry Dock and Construction Co. The dry-dock design, including assembly trusses, was made by William T. Donnelly, of New York.

Army Trade Skill Tests Applicable in Construction

Half an Hour Tells Whether Workman is Expert, or Merely Skilled, or Is a Novice— Clerks Can Conduct Tests

BY SIMPLE oral, picture and performance tests any contractor or works manager can determine whether a workman seeking employment is an expert, or is merely skilled, or is only a novice in his trade. This is the conclusion which may be drawn from the experience obtained in classifying the men of our new National Army, stated Col. Walter Dill Scott in an address before the Chicago Chamber of Commerce, Feb. 12, 1919.

Half of the men in a modern army must be skilled at special trades in order to perform their duties. The new Army had, of course, to avail itself of the trade knowledge and experience which recruits brought with them from civil life, since time was not available for training men in trade skill. To discover this talent and assign it where needed was the task of the Army personnel organization, in which Colonel Scott served.

Until Nov. 11, 1918, when the armistice went into effect, 250,000 men who had professed trade skill had received special trade tests. There had at that time been standardized 71 oral, 12 picture and 19 performance trade tests, and 42 additional picture tests and six additional performance tests were in preparation. Some of these main tests were subdivided, so that in reality the count was greater than the figures given indicate. For example, there was a test for carpenters and an extension of this test for ship carpenters. A single test, or any two tests, or all three tests were employed, depending upon the man or upon the trade.

Oral tests consisted of a series of weighted questions. If the applicant's answers counted less than 15 points he was graded among the novices; if they counted from 16 to 31 points he was graded among the apprentices; if they counted from 32 to 55 points he was graded as a journeyman; and if they counted over 55 points he was graded among the experts. Every question was written and had to be put as written; it could be repeated, but its wording could not be changed in the repetition. Thus the test could be conducted by any intelligent clerk, after a little training.

Performance tests were equally simple. If a carpenter, for example, the man received a rough-sawed 2 x 4 in. timber, say 2 ft. long, to fashion according to a blueprint plan. This print called for one end to be beveled, a dove-tail mortise to be cut in the opposite end, all four sides to be dressed, etc., all to the exact dimensions shown. All the tools necessary for the work were provided, and a time was set for completing the job. At the end of the period set, the work was examined, and by its approach toward completion and its quality and exactness the man was rated as an expert, a journeyman or an apprentice in skill, or merely as a novice. In the same way a blacksmith was required to make to blueprint a simple eyehook, using two pieces of metal so that his skill in welding would appear. As in the case of the carpenter, all needed tools were provided and a time limit was set.

Picture tests were intended to show the man's knowledge of the tools of his trade. If he were a horseshoer a large card on which were pictured ten or a dozen numbered tools and articles commonly used in horse-shoeing was shown him. He was asked to name No. 1, No. 2, and so on and was marked on the accuracy and precision of his designation of the tools and articles. Precision of definition was held important. For example, if picture No. 5 showed clinch tongs, it was reasoned that anyone could answer "tongs," but only a man who knew about horseshoeing would answer "clinch tongs."

An average of about 30 min. per man was required to make the tests. To determine how and where to place the men, job analyses were made. These gave for each department of the Army the number and kind of skilled men needed, and designated the degree of expertness required for each position. The task of fitting the man to the position was then comparatively certain.

Trade tests only have been mentioned; as a matter of fact, classification by similar methods was made of 3,365,000 enlisted men and 194,000 commissioned officers. When the war stopped, stated Colonel Scott, "the work was well under way, and in another year we should have had a real army in which we would have known the capacities of the men and the positions in which men of these capacities were needed. The process is equally applicable to any kind of business."

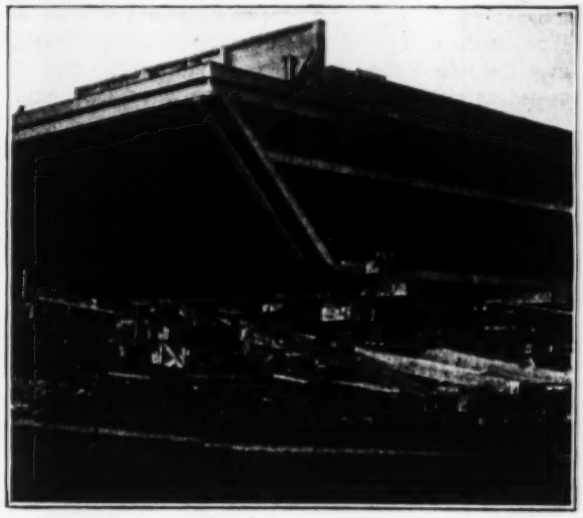
Side Launching a Concrete Lighter

After Concreting, Boat Is Lowered to Four Sliding Ways by Jacks and Is Launched by Releasing End Cables

CONCRETE lighters 112 ft. long, 11½ ft. deep and of 34-ft. beam, weighing about 500 tons, have been launched sideways at the yard of the Aberthaw Construction Co., at Providence, R. I. The construction of the lighters was described in *Engineering News-Record* of Oct. 7, 1918, p. 704.

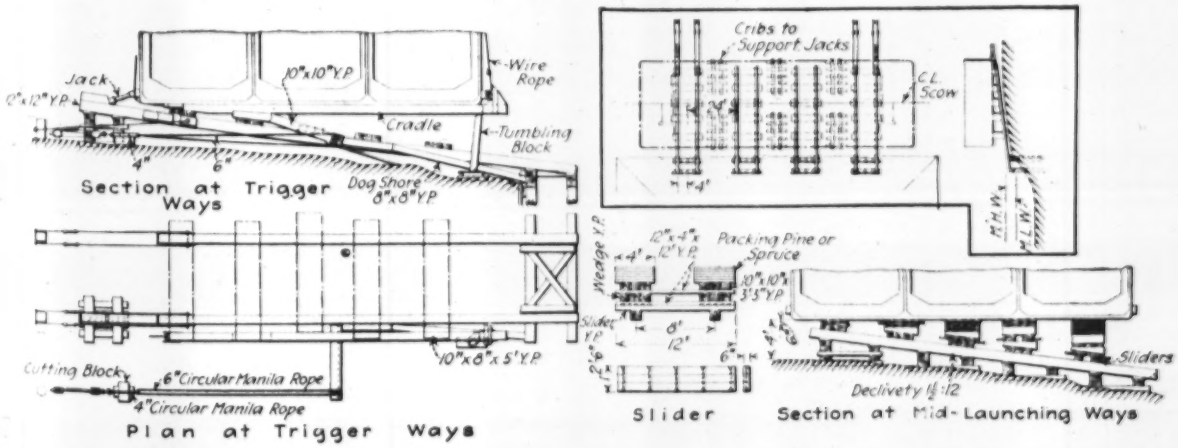
Four pairs of launching ways were placed under each lighter, the ways being built at mean high-water level, with the outer ends just awash at high tide, and the area immediately in front of the ways, 100 x 130 ft., was dredged out to a depth of 4 ft. The ways are set at an incline of 1½ in. in 12 in. and are built of 12 x 12-in. yellow pine, dressed smooth on the top and resting on sills laid in trenches, the outer end being supported on piling. Each pair of ways is 9 ft. wide, outside measurement, and the pairs are set at an interval of 24 ft. between centers. Across each pair of ways, under each longitudinal bulkhead and in the center of each water-tight compartment, was placed a yellow-pine slider which carried the wedges and blocking.

The outer unit of each pair of ways at either end



ONE END OF CONCRETE BARGE ABOUT TO BE LAUNCHED, SHOWING CRADLE AND TRIGGER

of the lighter constituted the trigger way, being extended to the rear and capped with a piece of yellow pine to afford a bearing surface for the base of jacks which served to start the vessel on the ways. The trigger ways were reinforced by two 1-in. round steel



DETAILS OF LAUNCHING AND TRIGGER WAYS FOR SIDE LAUNCHING OF THE ABERTHAW CONCRETE BARGES

bars fitted with turnbuckles and running back to deadmen which also served to anchor the block and tackle which formed part of the releasing gear.

Under the lighter at either end was placed a cradle of 10 x 10-in. yellow pine fitted with an eye at one end and at the other a lip which set against the side of the barge, the shoe being held snugly against the bottom of the lighter by a ¾-in. wire rope running up to the deck. On the under side of the shoe is a recess to take a strut running down to the trigger bar, which was a piece of 10 x 10-in. oak; the outer end of this was fastened to a deadman by a manila rope 6 in. in circumference, doubled and made taut by means of a block and tackle attached to the deadman in the rear of the launching way. The block is connected to the 6-in. cable by a double strand of 4-in. manila rope passing over the cutting block. From the outer side of the trigger a dog shore, 8 x 8 in., butted against the piling on the outer end of the launching way. Directly under the side of the barge was placed a tumbling block, beveled at either end; this fell clear when the lighter started down the ways.

When the concreting had been completed the barge was jacked up on building movers' jacks, carried on railroad ties on either side of each launching way, and the formwork was removed. The barge then was lowered to the blocking on the sliding ways. From this point, the barge was kept in place on the ways by the cradle shown, the strain being taken by the manila cables attached to the trigger bars.

A few turns on the jacks served to loosen the ship on the sliding ways, and, the signal being given, the releasing gear was severed simultaneously at the two cutting blocks. The resistance of the vessel striking the water broadside was sufficient to arrest the momentum, no rope stops being necessary.

Chloramine Tried by New York City

THE application of the chloramine process to the somewhat polluted water of Esopus Creek before it goes into the Ashokan reservoir at the head of the Catskill Aqueduct was described at the February meeting of the New York Section of the American Water-Works Association by Dr. Frank E. Hale, director of laboratories of the Department of Water Supply, New York City.

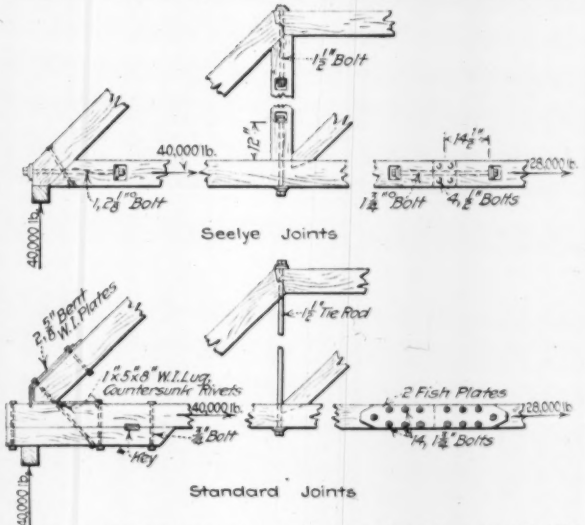
Although the water from the Ashokan reservoir has a long period of storage and is subjected to treatment with liquid chlorine before it reaches New York City, chlorination of the water of Esopus Creek before it reaches the reservoir was considered desirable. This was decided on in 1917 as soon as control of the Catskill watershed was taken over by the department. Local conditions prevailing at that time led to the adoption of hypochlorite instead of liquid chlorine for the Esopus Creek water. Immediately upon introduction of the hypochlorite (0.4 ppm.) complaints were received that the water was killing trout in the creek. This led to trial of the chloramine process (ammonia used with the hypochlorite), in an attempt to reduce the amount of chlorine and sludge. A material reduction in the unit rate of free chlorine applied (from 0.4 to 0.1 ppm.) was found to be possible, with good bacterial results and elimination of the fish problem, but the comparison of results obtained throughout more than a year's study indicated that equally good results were obtained by the use of hypochlorite alone. For example, the total bacteria and the B. coli removal with application of 0.05 ppm. available chlorine, bleach compared with chloramine, was, respectively, for bacteria 71% and 74%, and for B. coli 98% and 96%. These results indicated that the cost per unit of available chlorine applied for chloramine was double that of hypochlorite alone, since the ammonia cost four times as much as the hypochlorite, and the relative amounts of each applied were in the inverse ratio of one to four. This ratio was indicated by the experiments to be the correct ratio, the formation of chloramine being shown by a decidedly larger amount of free chlorine in the treated water than when bleach alone was used.

An important point brought out in the paper was that a given amount of available chlorine applied, and found by analysis to be actually in the water, did the same work—that is, percentage removal of bacteria and of B. coli—*at all temperatures*, winter or summer, from 32° F. to 76° F. Another point to be emphasized is that very small amounts of available chlorine may be effective in waters of low mineral and organic content.

The paper and discussion following brought out the fact that chloramine cannot safely be used except where there is very strict laboratory control, since otherwise the hypochlorite and the ammonia are likely to result in a variety of reactions and compounds, depending chiefly upon the proportion of chemicals applied and the strength of the solutions.

New Tension Joint for Wood Truss

BY APPLYING a type of tension joint common to certain kinds of cabinet work to wood trusses, Elwyn E. Seelye, consulting engineer, New York City, has made possible the framing of a truss in wood without the use of special plates, beveled washers, long



UPPER DETAIL SHOWS SEELYE WOOD-TRUSS JOINT AND LOWER SHOWS TYPICAL FRAMED JOINT

bolts, keys or complicated mortices. The joint, shown in the upper part of the cut, consists of a central bolt seated against the sides of through holes in the truss members. Comparison with the usual type of truss framing is made in the two drawings.

Fabricated Ship Construction at Bristol Yard

Plant and Operating System Closer to Precedent Than Those of Other Agency Yards—Reinforced-Concrete Shipways Flush with Ground—Tower Jib Cranes Traveling On Trestles—Pre-Assembly Practice

FABRICATED-SHIP construction at the Bristol yard of the Merchant Shipbuilding Corporation involves fabricating about 17% of the hull material in the yard shop. The working system, therefore, differs radically from that of Hog Island and Newark Bay, the two other original agency yards of the Emergency Fleet Corporation. Of these two, the former was planned for 100% and the latter for about 95% bridge-shop fabrication, as compared with the 83% of Bristol. In the planning of the Merchant yard this condition exerted a controlling influence, and led to close coordination of shop and berths. In this as well as in most other points of layout, shipyard precedent was largely adhered to. Furthermore, the derricks which at the other fabricating yards recall the bridge erector are not found at Bristol; in their place, traveling tower derricks are provided for the ship-erection service.

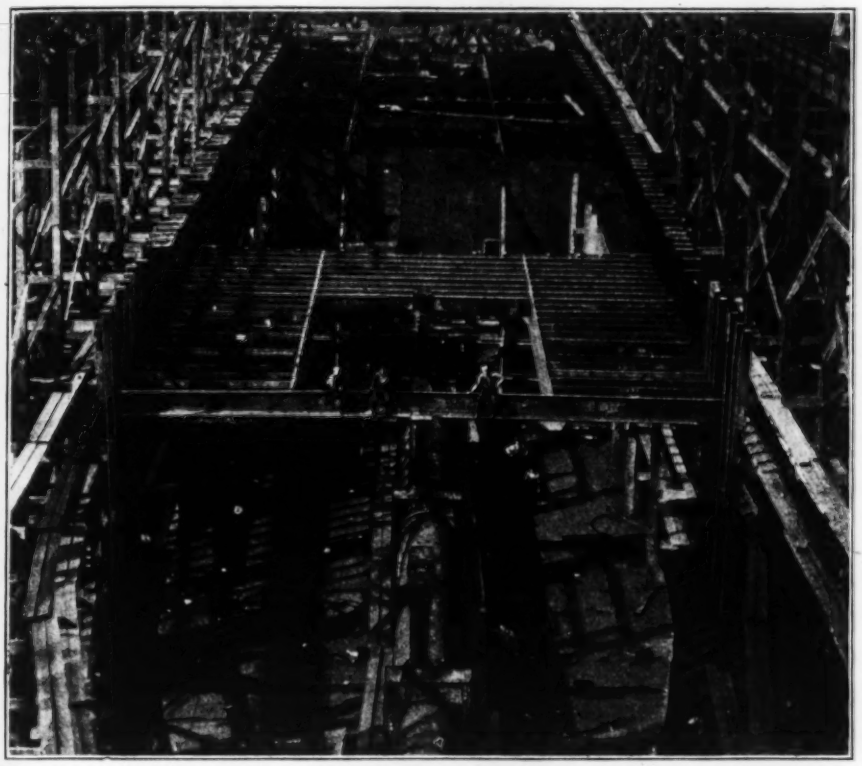


FIG. 1. MATERIAL FROM WAY-HEAD TRACK IS PLACED BY TOWER CRANES—PARALLEL MIDDLE BODY MAKES FABRICATION EASY

Included in the work fabricated in the shipyard punch shop are the following main items: All furnaced plates (in ends of shell as well as in keel and at knuckle), all bent frames, bottom angles on floor frames in forward and after sections, margin angles and web frames outside of the parallel body, frames and floors in peak, deck stringer angles at ends, ventilators and miscellaneous material. The work involved is estimated to cover about 40% of the total fabrication work required for the ship. The division was based on the desire to allot to the bridge shops only that work which they could do most economically with their existing equipment. Accordingly, of the bridge-shop material about 90% is either multiple-punched or rack-punched, and only about 10% single-punched.

To facilitate the outside fabrication as much as possible, the Merchant designers developed a transverse section of the 9000-ton ship which was to be built showing typical transverse rivet spacing, from which the shop men could set up their multiple punches direct. Pole templets for the longitudinal spacing of the multiple-punch rack could also be made from a drawing direct. The Merchant shop made templets only for the ends of the ship where the plates could not be multiple-punched; for this work it furnished the bridge company with one set of templets, which were then copied at the bridge shop to provide templets for the various plants at which the steel was to be fabricated. Rolled plates for the molded ends of the ship are punched at the bridge shop but are not rolled, so that they can be shipped flat; the rolling is done in the yard shop. Convenience in shipping also dictated the limit to which pre-assembly of parts at the bridge shops was carried. It is stated by officials that except for shipping reasons it would be possible to do approximately twice as much riveting in the bridge shop. According to the contract division of the work, the bridge shops drive about 100,000 rivets out of a total of 625,000 in the hull.

The general scheme indicated by the preceding was worked out for executing an order of the Emergency Fleet Corporation to build 40 steel cargo ships of about 9000 tons dead-weight carrying capacity. This order was subsequently increased to 60 ships of the same size. The contract time for completion of the order is about two years from September, 1917, when the contract was executed. Twelve shipways were laid out to carry this program through.

Character of Ship Design—Simplification of the design of the ship to adapt it to bridge-shop fabrication was not carried so far by the Merchant Shipbuilding Corporation as by the two other agency yards which

began work at the same time. The vessel is of the ordinary transverse-framed type with frames spaced generally 27 in. The bottom has a small amount of dead rise; the sides are vertical to the upper deck, but the bridge sides have 6-in. tumble-home. For easier fabrication, the parallel middle body was made very long, 50% of the length of the vessel, and the full decks were made flat (without sheer), sheer being given only to the forecastle and poop deck and the bulwarks. Transversely, the second deck has no camber, while the upper deck and the decks above have a straight pitch of 13½ in. to the center line amidships. The floors are, in general, alternately solid and bracket floors, the latter made of 7-in. channel frames with brackets at the center line and at the margin plate. The margin of the tank stop is turned down normal to the shell, and the floors here have no bent parts.

Shipbuilding Plant Compactly Grouped—In the layout of the shipyard, which was briefly sketched in advance of construction in *Engineering News-Record* of Jan. 3, 1918, p. 12, the important rôle assigned to the yard shop finds expression in unusually close grouping of the berths, and of shop and berths. The principal character of the layout, Fig. 2, was determined by certain local conditions, skilfully utilized by the designers to secure economy of construction.

A manufacturing plant, the works of the Standard Cast-Iron Pipe and Foundry Co., stood on the site, and two of the main foundry buildings of the plant were adaptable for use as the fabricating shop of the shipyard. These were long, narrow buildings standing end to end in a line parallel to the river bank and about 400 ft. back of the water; by a short connection between their adjoining ends they could be transformed into a

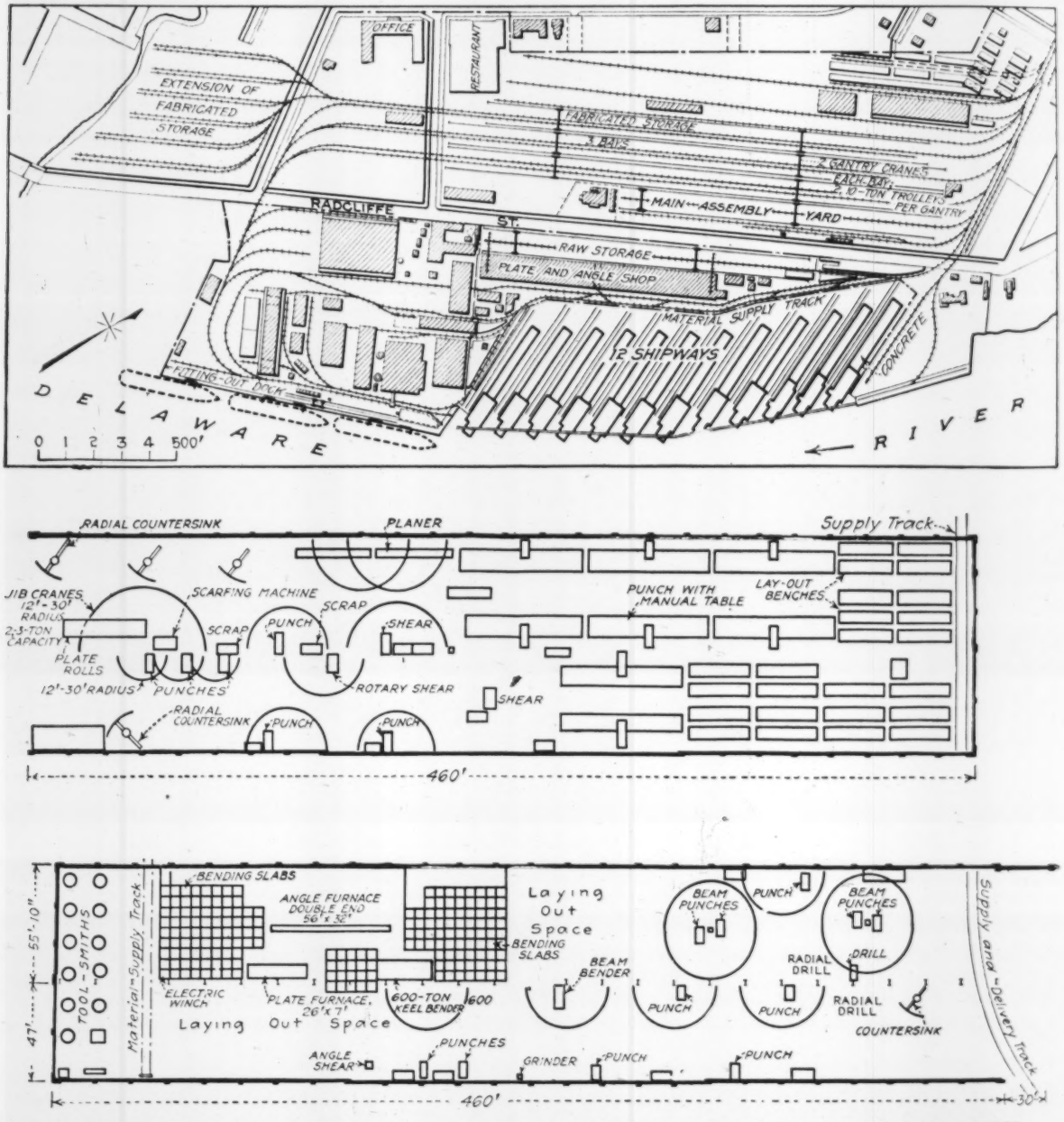


FIG. 2. GENERAL PLAN OF FABRICATED SHIPYARD AND LAYOUT OF PLATE-AND-ANGLE SHOP AT BRISTOL MERCHANT SHIPBUILDING CORPORATION, AGENT FOR EMERGENCY FLEET CORPORATION

single shop building 99 x 970 ft., giving ample space for the required fabricating capacity.

Because of these conditions, permanence of construction was made an objective in the design, at the same time with economy. Since the plant was built at the cost of the Emergency Fleet Corporation, only such expenditures were warranted as were necessary to create a shipbuilding plant of the desired capacity in the shortest possible time. However, as the site gave ideal opportunity for the construction of concrete ways, and the development of the necessary shop buildings was facilitated by the existing buildings of the pipe foundry, a shipyard of permanent character resulted quite naturally. According to the officials of the company, the concrete slab ways have proved entirely successful during the year of operation since shipbuilding started, early in the spring of 1918. There has been no settlement or other injury, and the construction has met all other service requirements.

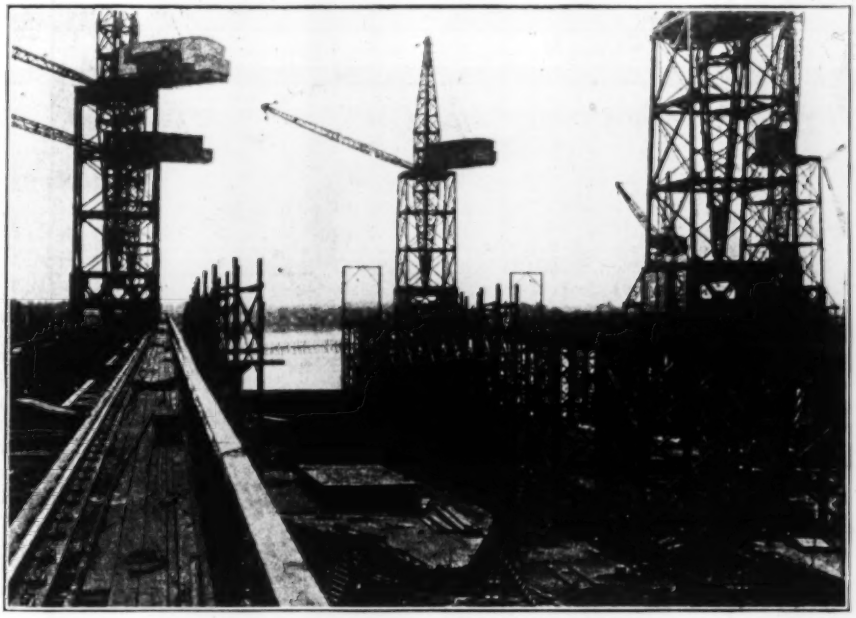


FIG. 3. SHIPBUILDING CRANES AT BRISTOL TRAVEL ON TRESTLES

In design the ways are composite (Fig. 4), consisting in part of concrete slabs 4 ft. thick by 38 ft. wide, and in part of reinforced-concrete beams supported by concrete piles. This is the typical construction above high-water mark. Below high water the ways are timber—wood piles with transverse wooden caps accommodating not only the keel blocks and the launching-way stringers but also abutments for the lateral shores of the standing ways. The sloping ground of the bank required but little grading to adjust it to the launching slope, and the ways were therefore constructed flush with the graded ground surface.

On account of the limited space between the shop building and the river, it was necessary to set the ways at an angle to the shore line in order to accommodate the 400-ft. ship length and have room for tracks and way-head storage space. This skew arrangement proved advantageous in enabling the ship-erection cranes to reach the supply tracks better than would have been the case with ways set square to the shore. The combination of skew and ground slope resulted in a slightly stepped profile in section parallel to the shore, there being a step 2 ft. high from each way to its neighbor; this, however, does not affect the shipbuilding operations.

While most of the other fabricating yards adopted fixed derricks for their shipbuilding machines, Bristol chose traveling cranes; and, instead of having longitudinal supply tracks between the ways to distribute material along the length of the ship, it has tracks across the head of the ways only. From these tracks all material is handled down along the berths by cranes. Omitting tracks between the ways made it possible to group the shipbuilding berths very compactly, as the plan, Fig. 2, indicates.

For each shipway two shipbuilding cranes were provided, placed as may be seen in the view, Fig. 3. Revolving jib cranes (Fig. 5) of the type built by the Terry Manufacturing Co., of New York, which had already found use in several shipyards, were chosen as the most suitable for the present service. Nine ways are equipped with these cranes. They have 92-ft. booms, and can lift five tons at extreme reach and 15 tons at 54-ft. reach (hook at center line of ship). The three northerly ways, however, are equipped with locomotive cranes of turntable type, six of which were available for service earlier than the Terry cranes. These machines, of the Brown Hoisting Machinery Co.'s design, have 72-ft. booms and can lift 15 tons at about 40-ft. reach. To make the maximum lifting capacity available practically at center line of ship, the ways in question were spaced 86½ to 97 ft., instead of 108 ft., as are the others.

Trestle supports for the travelers were necessary to give a level track, and it was considered desirable that the cranes should travel on an elevated track for their entire length. The inshore end of the trestle, therefore, was made high enough to give clearance for trucking underneath the bracing. Trucking roads or passageways were at one time contemplated, but they were discarded in the final development of the plan. The space under the trestles is in part occupied by service buildings, and in part used for storage of material awaiting erection, though most such material is held in racks or piled at the head of the way.

On account of the angle between the supply tracks and the crane runway, all the cranes are able to take material from cars on the supply tracks. Furthermore, on all the ways except the one at the north end of the group, four cranes can be concentrated on one ship. According to the yard authorities, the crane equipment has proved to be ample in capacity for all requirements.

Storage Facilities—As material fabricated at the bridge shops could not reach the yard in such sequence in timing as to enable the berths to be supplied direct from incoming cars, storage was a vital feature, and

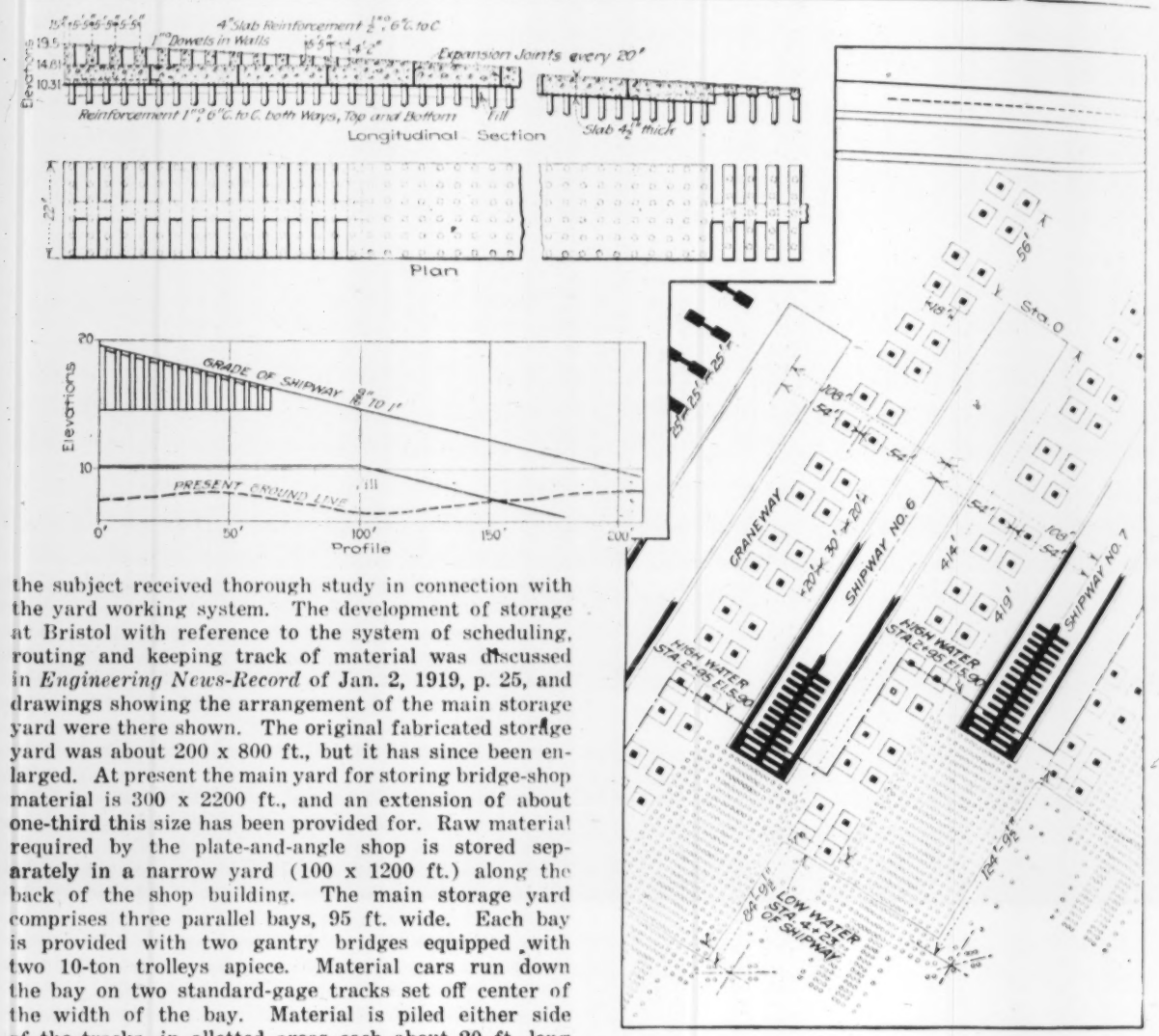


FIG. 4. REINFORCED-CONCRETE SLAB WAYS FLUSH WITH GROUND

the subject received thorough study in connection with the yard working system. The development of storage at Bristol with reference to the system of scheduling, routing and keeping track of material was discussed in *Engineering News-Record* of Jan. 2, 1919, p. 25, and drawings showing the arrangement of the main storage yard were there shown. The original fabricated storage yard was about 200 x 800 ft., but it has since been enlarged. At present the main yard for storing bridge-shop material is 300 x 2200 ft., and an extension of about one-third this size has been provided for. Raw material required by the plate-and-angle shop is stored separately in a narrow yard (100 x 1200 ft.) along the back of the shop building. The main storage yard comprises three parallel bays, 95 ft. wide. Each bay is provided with two gantry bridges equipped with two 10-ton trolleys apiece. Material cars run down the bay on two standard-gage tracks set off center of the width of the bay. Material is piled either side of the tracks, in allotted areas each about 20 ft. long in the direction of the tracks.

The storage yard is laid out with a definite space assigned to each piece in the ship. The problem of laying it out depended on the number of pieces rather than on the tonnage involved, the latter being simply a matter of higher piling.

In the operation of the plant the storage facilities are of central importance, because the whole system has been worked out to provide storage intermediate between shop and ship, and to avoid working direct from shop to ship in any department.

Shop-to-Storage-to-Ship System—Incoming cars of material fabricated at the outside bridge shops run directly into the main storage yard, and are there unloaded, and the material is placed in its allotted storage space by the gantry cranes. An essential piece of work at this point is painting the erection mark on each piece, the shop marks chosen by the bridge shops for their convenience being different from the ship erection marks. From storage, material is drawn on requisitions by any one shipway, according to the needs of the day.

Material fabricated in the yard shop is in part also worked through storage, in order to render the operation of the shop independent of the variations of the berth requirements. This material is of two kinds, templeted and lifted material. The latter, fabricated on special order from the shipway at the time when needed, does not go to storage. Templeted material, however, is worked ahead or on stock, and all this goes to the fabricated-storage yard just as does the incoming bridge-shop material. Similarly, such parts as are fabricated up to a certain point by the bridge shop and have finishing operations, such as rolling, bending or riveting, put on them by the yard shop, go from the fabricated-storage yard (where deposited when unloaded) to the yard shop, and then are returned to the storage yard to await call from the shipways.

Pre-Assembly Highly Developed—In carrying on the routine of minor assembly work, such as that on web frames, stringers, and other curved members, which, because of containing formed work, were not made or were only partly completed by the bridge shop, the Merchant yard during the year has been led to develop pre-assembly to a remarkable extent. An assembly yard 100 x 700 ft. was provided at the start, but it was

later increased to a length of 1300 ft. In addition, a space at the end of the plant north of the ways was available for assembly work.

Facilities for supplying and handling material and suitable tool equipment are features of the large assembly yard. This yard, at one end of the fabricated-storage yard, is spanned by a gantry like those of the storage yard, but has only one longitudinal track. Air-outlet manifolds are placed along the sides at about 20-ft. centers. For the smaller work, such as that on web frames and stringers, a shelter shed about 40 x 40 ft. is provided in the center of the bay, with two air-operated bull riveters. All other riveting is done by pneumatic hammers.

The larger parts that go through assembly, in its present development, are: All deck houses, shaft tunnels, bulkheads, the complete fantail with part of its plating, and the entire keelson with the flat keel riveted to it in lengths of 60 to 100 ft. The splices between these keel sections are ready reamed for final assembly on the keel-blocks. The bow section of the keel is assembled with attached frames. The heaviest members are the large bulkheads and deck houses, weighing 25 tons; these are handled by two cranes. They are assembled in the assembly space north of the raw-material yard, and when completed are loaded on cars by locomotive cranes and shifted along to points within reach of the berth cranes.

In this same assembly space the fitting up and assembling of the keel and keelson girder are carried on. The assembled keel is set up on horses for the full length of the ship, riveted complete in sections 60 to 100 ft. long, and the splices between sections are reamed ready for riveting on the keel-blocks.

This process is carried still further in the case of the bow section of the keel, where, for a length of 11 frames back of the stem, the lower pieces of the frames are riveted to the keelson girder in the assembly yard, thus making a single erection piece out of nearly 30 separate shop pieces.

A still further extension of pre-assembly is contemplated by the corporation. D. D. Smith, assistant general manager, says it is expected that ultimately something like 40% of the hull weight will be involved in the pre-assembly work. This will mean a largely increased amount of shop riveting.

Supply Racks at Head of Ways—Ship erection is carried on from a small way storage at the head of the way, and not from the supply cars direct. Steel plate-racks are provided here, with piling space alongside for floors, frames and similar members. The original intention was to stow all ship material under the crane trestles, but the way-head storage is found more convenient.

Engineering and Fitting Out—The southerly half of the yard area is developed for manufacturing and storage of engineering and ship equipment supplies and for the fitting-out work. Along the river front a timber wharf 1150 ft. long gives berthing space for three vessels engaged in outfitting. Traveling on a track laid on this dock is a large 60-ton luffing-jib crane capable of doing all the heavy hoisting work in placing boilers and machinery on the ship. This crane was described in *Engineering News-Record* of Nov. 21, 1918, p. 937. It is to be supplemented for lighter work by a quick-moving crane, on the same tracks. This will have 15 tons capacity at 54 ft., and 5 tons at 100-ft. radius.

In the case of the ships built at the Merchant yard up to the present, the boilers and turbines have been set in place before launching, and it is intended to continue this practice so long as the machinery supply keeps ahead of ship construction, though the fitting-out crane equipment is capable of setting all machinery at the fitting-out dock. The boilers of the Merchant ships are relatively light. If necessary to install Scotch boilers, however, they would have to be handled at the fitting-out dock. This was one reason for the 60-ton load capacity of the fitting-out crane.

The principal officials of the Merchant Shipbuilding Corporation are R. H. M. Robinson, president; W. T. Smith, vice-president; G. C. Thayer, general manager, and D. D. Smith, assistant general manager. H. E. Frick is the authorized representative at the plant for the Emergency Fleet Corporation.

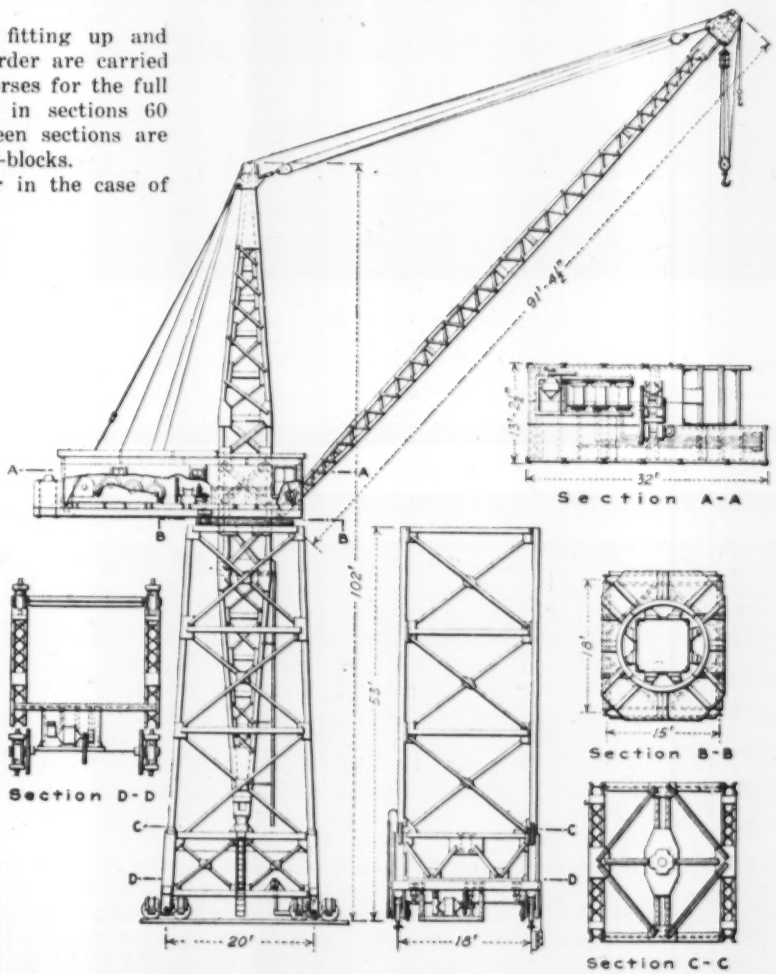


FIG. 5. REVOLVING TOWER JIB CRANES SERVE THE BERTHS

The Construction Division of Our Army: Operation and Maintenance Functions

Organized in Eight Sections—Each Completed Project in Charge of Utility Officer—Plea for Continuance as Independent Unit of Military Establishment

By George W. Fuller
Consulting Engineer, New York City

In A previous article, in *Engineering News-Record* of Feb. 27, 1919, p. 416, the writer sketched the development which established the Construction Division of the Army as an independent organization reporting directly to the General Staff. The magnitude of the work was set forth, and some stress was laid on the type of the responsible organization, embodying as it does the experience and personnel of numerous successful civilian concerns.

In the present article, the writer endeavors to portray briefly the organization of the Building Division and also to set out both the work and the organization of the Operating and Maintenance Division. This more detailed description of those two branches of the Construction Division is of general interest both from the subject matter itself and the bearing which it has on the important question of preserving the division as an adequate entity and with a personnel commensurate with the work still to be performed. There will be set forth in a later issue some maintenance costs and other operating data of interest to engineers engaged in the utility field.

Organization of the Building Division

The principal scheme in the organization of the Building Division is the separation of the construction work into six groups or sections, each under the direction of a section chief whose work embraces one or more types of projects. For example, one section chief handles all ordnance work, another warehouse and terminals, another camps and cantonments, and so on; each section chief has four general assisting units, consisting of an engineering unit, an administrative unit, a materials expediting unit and the unit in charge of estimates and costs. The two latter units act as liaison officers with the Procurement and Engineering Division.

Under each section chief the direction of the field operations again divides geographically under the control of four or five supervising constructing quartermasters, each of whom is responsible for the work of from five to fifteen different projects. The constructing quartermaster, who is the Army's chief representative in the field, communicates with Washington only through his supervising constructing quartermaster, who thereby is enabled at all times to keep in touch with the progress of the work.

Serving all sections and acting as a part of the Building Division there is set up a Requirements Branch, which is charged with all questions dealing with special requirements, including responsibility for the allotment of funds to the various jobs. Furthermore, it has supervision of all requests for funds and statements covering new work which are sent to the Secretary of War or General Staff for approval, and the preparation of necessary reports and statements to the various Congressional and Senate committees and the War College, and of other similar requests for data.

Even after construction is completed and the project put in use, the duties of the Construction Division are by no means finished. Indeed, the operating problem begins before the construction work ends, as the housing of troops commenced, for example, before the camps were finished. Some agency must be set up for a wide range of tasks, such as keeping the streets and roads in repair, operating and maintaining the water and sewerage systems, operating the electric-light and power systems, and making repairs and minor alterations to the thousands of buildings. These are the functions of the Operation and Maintenance branch (officially known since September, 1918, as the Maintenance and Repair Division) of the Construction Division; they have to be exercised at military posts, camps, cantonments, hospitals, terminals, depots and other establishments coming within the jurisdiction of the War Department.

Earliest Efforts at Maintenance and Operation

During 1917 and the early part of 1918, when the Construction Division (or Cantonment Division, as it was then called) was a part of the office of the Quartermaster General, the field forces engaged in operation and maintenance were under the jurisdiction of the local camp quartermasters. These officers were naturally picked for the better known duties of quartermaster—subsistence and personnel supplies, troop transportation, pay, etc.—and their hands were amply full with such duties. Naturally, their experience with operation and maintenance on Army reservations was on the small-post peace-time basis, where the big-cantonment war-time problems never arose. Therefore, the first utility officers placed in immediate charge of cantonment operation and maintenance labored under truly enormous handicaps. There were (1) a deficiency of enlisted personnel; (2) a lack of local appreciation, higher up, of the number of men and the amounts of material demanded by the situation; (3) a slowness in organizing in Washington a centralized operation and maintenance bureau to give adequate help to the local forces. The severe winter of 1917-18 still further added to the burdens of the field forces, and—in the northern cantonments, at least—the camps were kept running only by long hours of arduous duty on the part of officers and men, and by twisting the Army regulation red tape considerably out of its intended form. It is needless here to do more than mention the indefinite and apparently overlapping jurisdictions, during this period, of camp quartermaster, camp surgeon, sanitary corps representatives (medical department) in relation to the utility officers who had to deal also with representatives from numerous offices in Washington.

It was not until the Cantonment Division emerged from under the wing of the Quartermaster General's office that proper development of the operating division was possible. Then the local utility forces were dis-

sociated from the local quartermasters and made directly responsible to the military commander of the reservation and to the division now called the Construction Division, which supervised the work and the funds required therefor.

It was in May, 1918, that utility operations received their first impetus toward adequate expansion. However, the Army deficiency bill, of March, 1918, provided no funds for betterments, and the expansion program proceeded in a restricted way. With the beginning of the new fiscal year, July 1, adequate authorization came for increased personnel and for needed funds. Especially in view of shortages of men and material, much credit is due those who sought to bring methods successful in similar civilian undertakings to the aid of the large Army camps.

Organization for Operation and Maintenance

By the end of 1918 there were under the jurisdiction of the Maintenance and Repair Division the roads, buildings and public utilities in 46 camps and cantonments; 51 hospitals; 66 border stations; 25 supply depots and terminals and 171 regular military posts. For the fiscal year ending June 30, 1919, the funds for its use amount to $62,400,000.

It had as a field force, concerned with the actual operation of its functions at all of these points, 452 commissioned officers and 16,559 enlisted men. The maintenance and repair personnel in the Washington office consisted on that date of 40 commissioned officers and 126 civilians, of whom about 90 have been engaged in work for the entire Construction Division in the blueprinting and photostat rooms.

The organization of the Operation and Maintenance Division parallels the general scheme of the Construction Division of the Army in that it follows so far as practicable the precedents indicated by civilian experience on a large scale. The division is divided into a series of eight branches or sections: (1) Personnel; (2) service; (3) statistics; (4) procurement, which has been combined with the service section; (5) building repair; (6) fire protection; (7) light, heat, power and refrigeration; (8) water and sewerage.

Coördination of Central Office and Field Forces

To keep in touch with these utilities at so many posts and locations requires an efficient and complete central organization. At the same time, such a bureau must not be so highly organized as to impede its own work. The Washington office, in order to maintain intelligent supervision of these utilities scattered all over the United States, must be kept advised as to what is going on, as well as to what are the actual needs. Utilities officers look to Washington for prompt authorization of funds for repairs and extensions, for advice on matters of policy, and for information on countless points which arise.

There are two methods by which the central office acquires information. One is by reports of inspectors, and the other is by the study of the reports of the utilities officers themselves. A utilities officer is busy and has little time for the preparation of reports. Accordingly, only monthly statements, containing information in the most concise and brief forms, are required. These reports are usually headed by a summary outlining matter of particular importance, recommendations as to needs, etc.

When a report is received from a camp or other location, it does not follow the commonly supposed fate of such Government documents, that of being filed away in archives without other than a hasty examination. It is carefully studied for two purposes; (1) To find out what has occurred during the previous month at the job, and (2) to analyze the proposition better from the viewpoint of efficient and economical operation. The report is scrutinized by the chiefs of sections or branches, who attach memoranda with any comments or remarks. The officer in charge of the Maintenance and Repair Division then studies the questions of policy, and conditions requiring correction are noted, and communications with instructions are prepared through the aid of the memoranda attached by the section chiefs, and forwarded to the local or camp utilities officer.

At each completed project, in charge of the operating force is an officer selected on his record in civil life in the management of public utilities, holding a position comparable to that of a city manager, but with detailed responsibilities and duties far transcending those of such an official. Indeed, he is a composite of city manager, city engineer, fire marshal, street and building inspectors, managers of municipal water-works and sewers and telephone and electric-supply companies and cold storage, besides being general all-round handyman to whom everybody comes to get anything fixed.

The local organization is military in its character, and was worked out with a view to obtaining the greatest efficiency and the best results with a minimum of personnel and expense. A major is usually placed in charge of this highly important work, and has as assistants a number of commissioned officers of lower grade. For operative and clerical assistants there is a detachment of enlisted men, depending as to the number upon the size of the project, but varying from 300 to 800 in various camps and cantonments.

Each utilities officer maintains in his office a "trouble department"—a desk over which passes every complaint of whatever nature and every request for repairs and replacements. In addition to the written communications received, the number of telephone calls in the trouble department at each camp alone averages several hundred per day. All the work is supervised, coördinated and administered from the Washington office. Refinements and economies are constantly worked out, and their effect is always toward giving the greatest service with a minimum expenditure of public funds. The Maintenance and Repair Division of the Construction Division's office is really a huge service organization operating for the benefit of over a million persons, and designated to supply them with every convenience and comfort incident to their existence as soldiers stationed at Army posts.

Future Work of the Construction Division

The writer will endeavor to set out below a brief consideration of some of the factors affecting the future operations of the division and the volume of work to be done in peace times.

When the armistice came in November the Construction Division had under way or completed nearly 1000 contracts for new construction work and was operating utilities at and keeping in repair about 350 military establishments.

While during peace times the demands for so extensive a program will cease to exist, nevertheless, to

provide proper housing for an army of 175,000 men will call for additional permanent construction equal to nearly twice that existing previous to the war.

Undoubtedly, many of the large Army camps will be retained, and the temporary buildings will be improved to provide more comfortable quarters and to give them a more permanent character. This work will extend over a period of years and will total a substantial amount. Then, too, the housing construction on the Mexican border has been of a most temporary and frequently makeshift nature, and much new construction of a more durable type is badly needed there. With our small pre-war army of 70,000 men, the annual building operations were of considerable magnitude, so it is obvious that whether the future Army consists of 175,000 men, or 500,000 men or more, as desired by the advocates of universal military training, the annual new construction for the Army will total many millions. As a matter of fact, there is now proposed one project, a permanent school for the Corps of Engineers, which alone will probably cost from $25,000,000 to $30,000,000. If all other new construction combined for the next fiscal year is only three or four times that of the new school for engineers the total will range from $120,000,000 to $150,000,000.

It has been pointed out in these pages that operation and maintenance and ordinary upkeep form a large undertaking, involving, as they do, investments in structures of a temporary character, whose worth is about $500,000,000, and requiring at present monthly expenditures of about $4,000,000.

Operation and maintenance activities and expenditures will be reduced, but never to a point comparable with the pre-war expenditures. One reason for this is that the pre-war practice of housing troops in widely scattered posts of very small capacity prevented any possibility of training the Army in maneuvers or of mobilizing the men in any way for modern training on a large scale, and the experience of the war has clearly proved the need of maintaining large training centers such as the cantonments provide. Therefore, the operation and maintenance of at least a large percentage of them must continue, as well as many hospitals and also supply depots and terminals representing permanent investments.

Large Expenditures Required

Even though exact figures cannot be foretold, it is clear that even in peace times new construction and operation and maintenance will require large expenditures. It would be unwise and inconsistent with good business to place responsibility for such work in the hands of those unfitted by training or experience to handle these matters, and more especially is this true when it is remembered that there now exists in the Construction Division a highly specialized organization of experienced civilian engineers. These men have made good under unprecedented demands and conditions. No untried agency can handle as efficiently or economically the peace-time requirements.

Some of the lessons of the war stand out strikingly. We were entirely unprepared for war, and most of all in those lines of work of the military establishment where those in responsible positions needed a thorough knowledge of commercial practices and the hard, keen business sense acquired through commercial experience. In the regular military establishment there is no opportunity for the soldier to acquire training or experience akin to that obtained in large civilian organizations. Ordinarily, his training is such as to give him no idea of the value of a dollar or of competitive conditions of production and procurement. From the time he enters West Point the officer is in a measure set aside from commercial pursuits, and if his line of duty brings him in contact with matters of engineering or production he nevertheless loses the value of the practical and competitive circumstances under which his civilian brother labors.

Division Met All Demands

Because it was a civilian organization reinforced with a knowledge, through years of practical experience, of how to obtain materials, transportation and results in the face of adverse conditions, the Construction Division was able to "deliver the goods." The obstacles overcome were not alone those in the field or in the actual construction or operating activities. In fact, the greatest handicap, especially at the start, was the lack of preparedness for the work to be done. Obstacles could not in any large measure be studied in advance, but under the press of immediate needs each problem had to be solved as it arose, and the rapidly increasing scope of the work called for constant changes in the organization. It is fortunate that those experienced constructors who were early called to the division selected certain broad principles of organization which stood the test of constant expansion. Even so, mistakes were made, principally because when the war was started there was no complete scheme of organization susceptible of unlimited expansion and no program for immediately starting construction activities. But the division, nevertheless, met all demands made on it. Praise without stint is due those who put through and were responsible for this great engineering and constructive work, and it should be their reward, as many of them return to civil life, that they go with the knowledge that unquestionably, for the public good, profit has been taken from their successes and their failures and the organization they built shall neither pass out of existence nor lose, by absorption into some other bureaus of the War Department, its entity and that strength which it now has by virtue of the rich practical experience of its civilian engineers and constructors, whether in uniform or not.

There has been suggested a Department of Public Works to handle all construction activities of the various bureaus of the Government. The retention of the Construction Division of the Army would perhaps serve to give an instrument ready at hand in connection with the establishment of such a Department of Public Works.

Pre-War and Present Highway Costs

In 1915 the New York State Highway Department constructed 1073 miles of highways, at an aggregate cost of $11,790,000. At present prices of labor and material but little over one-half of this mileage could be awarded at the above sum, according to the annual report of Edwin Duffey, state highway commissioner. A comparison of the pre-war and present costs of pavements is given in the report as follows:

Item	Cost per Mile	
	Pre-war	Present
Water-bound macadam	$12,000	$18,000
Bituminous macadam	14,000	23,000
Concrete	18,000	28,000
Brick	25,000	$5,000

Accurate and Compact Record of City Property

New Castle, Penn., Has System of Maps and Forms Covering Entire City to Record Property Titles and Transfers

A SYSTEM for keeping city records of real estate titles has been worked out in the City of New Castle, Penn., under the supervision of C. H. Milholland, city engineer. It consists of various maps, forms, numbering and index marks to locate readily the data for any particular parcel of land within the city limits. The aim is compliance with the Pennsylvania state law, which requires that such a record be kept in all third-class cities.

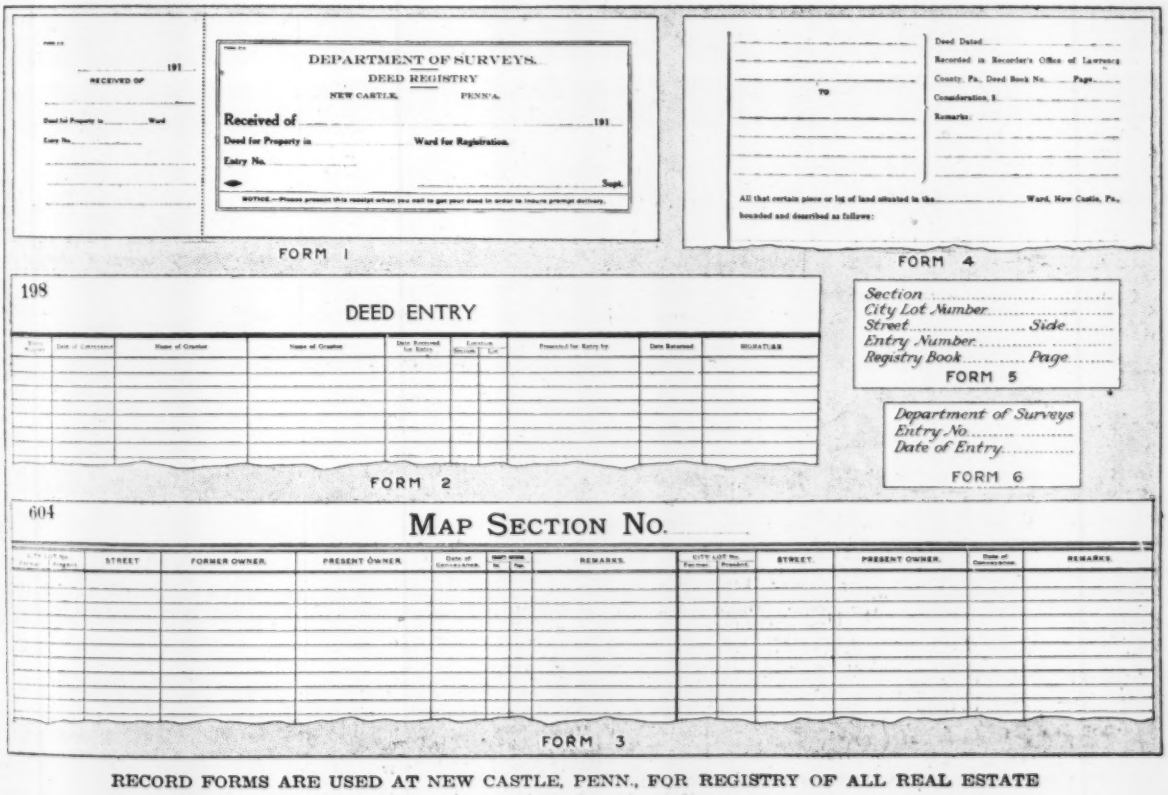
In establishing such a system the first step is to make an accurate set of maps showing the street and property lines of the city. A complete survey was made of all streets, and stone monuments, 4 ft. in length and 8 in. square, were placed at each street intersection or street corner. These monuments were also placed so as to be used as bench marks.

As a basis for the preparation of the maps, the city was divided by the city ordinance into 100 sections. The ordinance also provided that each city lot should have a number, so that each lot could be designated as lot No. ——, section ——. Where subsequent subdivision of any lot or tract of land occurs, it is prescribed that each subdivision shall receive the same number, with a letter of the alphabet added to distinguish the various subdivisions.

The scale chosen for the maps was 50 ft. to the inch, this requiring sheets 30 x 48 in. These were made of linen-backed paper. Upon them are shown the center lines of the streets, with bearing and distance in red; stone monuments as small black squares; street lines, lot lines and lot distances in black, and the recorded plot number, if there is one, in blue. Each of the 100 sections has lot numbers running from 1 to 600, and these are shown in red figures. For the purpose of obtaining the information required, the city ordinance provided that each owner of real estate should submit his deeds to the city engineer for registry and prescribed suitable penalties for failure to comply. These original drawings are not shown to or handled by the general public, but tracings of them have been made on which the name of the owner is shown in black, and when there is a transfer of ownership the name is changed.

When deeds are presented, Form 1, as here reproduced, is used to give the owner a receipt. These receipt forms are in a book of about 200 pages. When the deed is returned this receipt must be presented and signed by the owner. Form 2 is used in registering the submission of a deed for entry, and recording the various information as shown. The last column provides for the signature of the owner when the deed is returned. This form is made in a book of 200 pages.

When the registry has been made a book of 600 pages, the headings of one of which are shown in Form 3, is used to record the registry with the proper city lot number, the section number, etc. The form provides for 14 transfers of property. On the map as described above are placed in yellow figures the number of the



RECORD FORMS ARE USED AT NEW CASTLE, PENN., FOR REGISTRY OF ALL REAL ESTATE

registry book and the page; thus 2/25 shows that the lot is recorded in Book 2 on p. 25 of Form 3.

Records of the description of deeds are kept in a steel filing case with 100 files—one file for each of the 100 sections in the city.

Form 4, copy of the deed, is folded and stamped upon the back with Form 5 and placed in its numerical order in the files. Form 6 is stamped upon the deed when it is returned, and is evidence that the law has been complied with. The state law provides that, unless such stamp is found upon a deed, it cannot be recorded by county authorities.

This system of registry may be kept in compact form by having a combination plan case and book rack. At New Castle the plans are kept in 10 drawers, 10 plans to a drawer. The corresponding books are kept in 10 racks placed beside the drawers, the supports for the books being rollers, for easy handling.

After the installation of the system the council authorized the appointment of a registry superintendent, who attends to the details, furnishes copies of transfers to the city assessors and marks same on their plans. He also acts as clerk in the engineering office, issues street permits, shows plans when requested, etc. Mr. Milholland states that, after operating for some time, these methods have been found quite satisfactory.

Rotary Screens Remove Dirt from Water at St. Paul

Drums Have Shells Built Up of Screen Sections—Wash Water Received by Hopper Is Discharged Through Axle

MOTOR-DRIVEN rotary screens of the drum or cylindrical type are being used for removing vegetation and solid particles from the drinking water at St. Paul, Minn., and, it is reported, are giving satisfaction.

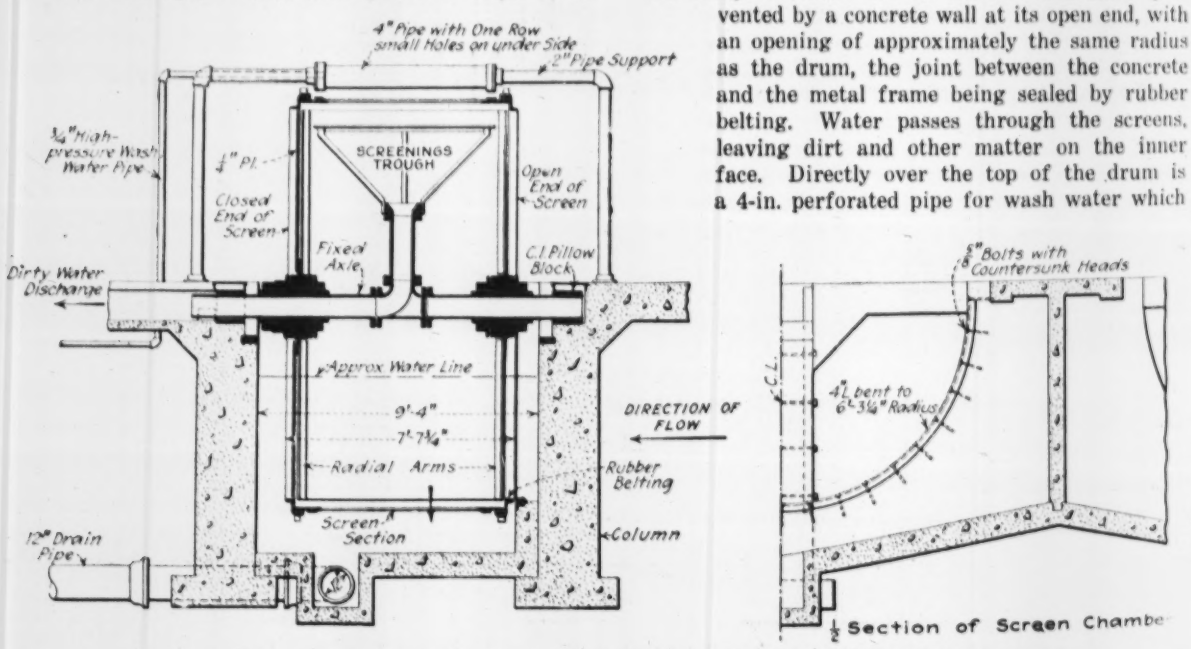
They were put in service in November, 1917, and have operated continuously since that time, requiring practically no attention. Two screens are installed, with space for a third. Stationary screens used previously were difficult to clean and required almost constant care.

Each screen is about 14 ft. in diameter and 7 ft. long, having a framework of structural steel and being mounted on an 8-in. horizontal shaft. One end is open for the entrance of water, while the other is closed by steel plates. The frame is covered with 24 sections of 80-mesh screens of monel metal, reinforced by a ½-in. mesh of No. 8 copper wire. The shaft is fixed and the screen drum revolves upon it, being carried by two sets of roller bearings, so that little power is required to drive the screen. For each screen there is a 7½-hp. motor geared to a cross shaft having pinions which engage two circular racks on the screen, as shown, any

MOTOR-DRIVEN DRUMS SCREEN WATER-SUPPLY

tension being taken up by a differential gear. A speed regulator and two changes in the gears provide for varying speed to suit cleaning required. Normally, the screen makes about one revolution per minute.

The escape of water around the screen drum is prevented by a concrete wall at its open end, with an opening of approximately the same radius as the drum, the joint between the concrete and the metal frame being sealed by rubber belting. Water passes through the screens, leaving dirt and other matter on the inner face. Directly over the top of the drum is a 4-in. perforated pipe for wash water which



WASH-WATER HOPPER IN DRUM DISCHARGES THROUGH HOLLOW AXLE

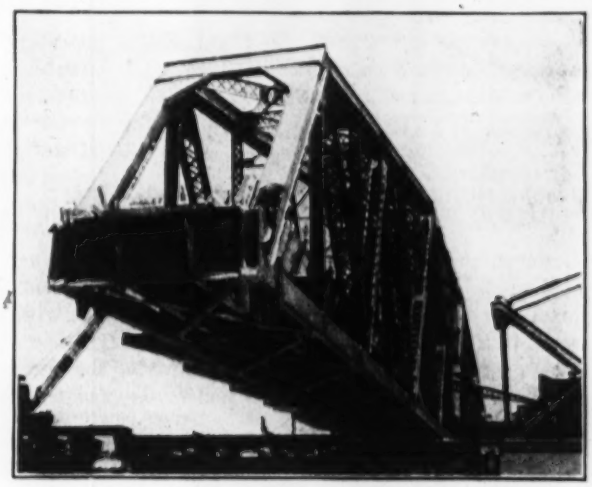
is discharged under 85-lb. pressure. Inside the upper part of the drum is a 4 x 6-in. trough or hopper, which receives the wash-water and dirt. In this way the screen can be cleaned continually with about two gallons of wash water during each revolution. It has been found, however, that the screens operate effectively when the wash water is turned on during one revolution about every 30 minutes. During 1918 the two screens passed about 17,000,000 gal. daily, while the maximum capacity per screen is estimated at 30,000,000 gal. a day. The screen chamber is so built that either or both screens can be shut off and the water passed around them without screening.

These screens were designed under the direction of G. O. House and W. N. Jones, who were, respectively, general superintendent and engineer of the Bureau of Water at that time. They were built by the St. Paul Foundry Co. The screen chamber was designed and constructed by J. W. Kelsey and L. N. Thompson, engineers of the Bureau of Water, all work being done by force account.

Cantilever Erection of Draw in Open Position While Old Draw Serves as Fixed Span

New Swing Span Part of Union Pacific Bridge Over Missouri at St. Joseph—Old Span During Work Carried Traffic

CONSTRUCTION of a new 465-ft. swing span on a new pier, to replace the old 358-ft. span, was the second step in the improvement of the Union Pacific Ry. bridge over the Missouri River at St. Joseph, Mo. The first step was the shifting of three 297-ft. fixed spans longitudinally for a distance of 136 ft. Owing to the condition of the old masonry, it became necessary to build new piers, and as an increase in length of drawspan was imposed by the War Department, it was decided to keep the bridge on its original alignment, building new piers between the old ones. The work of shifting the fixed spans into the new position was described in *Engineering-News Record* of Mar. 13, 1919, p. 550. During the erection of the new drawspan, traffic had to be maintained over the bridge, and this averaged about 75 trains and 400 teams and automobiles daily. River traffic also had to be considered, and for this a temporary lift span was provided. This was not needed, however, as all the work at the draw was done in the winter, while the river was closed to navigation.



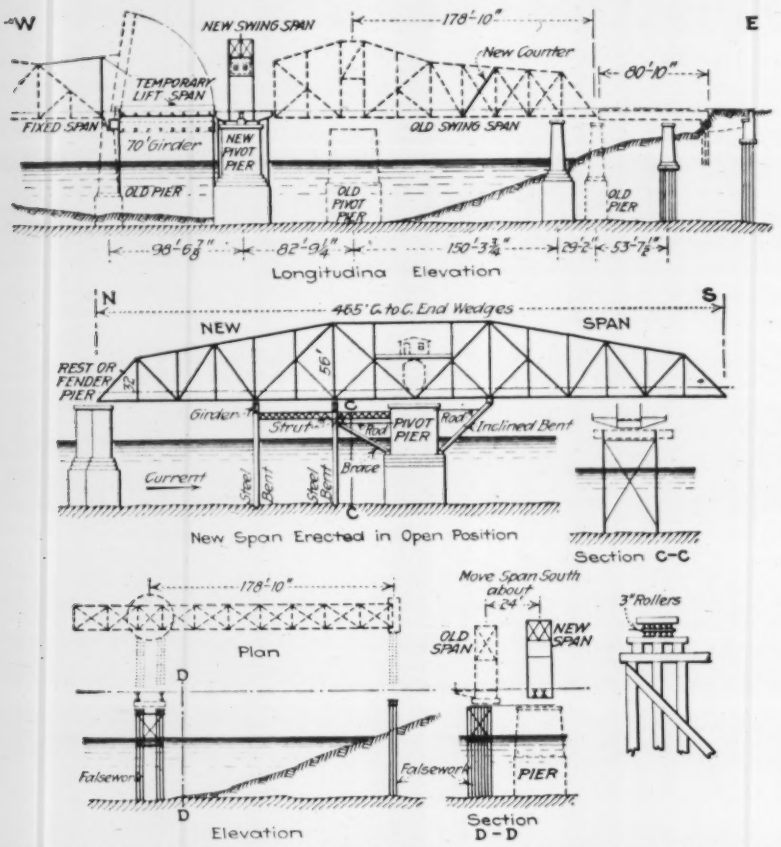
NEW SWING SPAN IS COMPLETED IN OPEN POSITION

Erection of the new drawspan was facilitated by the fact that this span was to be placed on a new pivot pier, in line with, but 83 ft. west of the old span. By erecting it in its open position the only interference was at the point of intersection. The old draw, therefore, was left in place, in its closed position, as a fixed span, but five panels of its west arm were cut off to make room for the new work. The layout of the erection scheme is shown in the accompanying diagrams. Work was commenced as soon as the shifting of the fixed spans had been completed.

A cantilever arm was formed by this shortened or bobtail west arm of the old span, with its end floor-beams only about 2 ft. from the ends of two of the roadway floor-beam brackets of the new draw, these being practically in line with the stringers of the old draw. Blocks bolted to the face of the floor-beam and to the ends of the brackets supported cross-timbers which closed the gap and on which were laid the intermediate ties. To prevent any yielding or lateral movement of the brackets they were supported by a timber bent having its cap cut to the slope of the brackets, as shown in one of the drawings. Removal of the end panels of the old drawspan, as noted above, left an opening between the new pivot pier and the west pier of the old draw. This was utilized for the temporary navigation channel, as shown. A through girder span of 70 ft. was placed here, being pivoted over the old pier and designed to be raised by tackles. Owing to the early closing of the river by ice, however, it was evident that it would not be necessary to operate it. Therefore, when the trusses of the old draw were cut off to permit the erection of the new span in its open position, the floor of the old draw was blocked up on the 70-ft. girders, and traffic was maintained over it without disturbing the track.

To carry the operating track through the new span during its erection, ties were laid temporarily on the drum of that span. The traveler erecting the new span was able to cross this track without disturbing it, by means of rails having slots cut in the webs so that they could be dropped over the rails of the operating track. These slotted rails were removed as soon as the traveler had passed.

As the bridge is raised to a new grade, a temporary



STEEL BENT AND GIRDER SUPPORT PANEL POINT OF NEW DRAW DURING ERECTION OF MISSOURI PACIFIC BRIDGE AT ST. JOSEPH, MO.

inclined runoff was required to connect the new elevation on the bridge with the old grade on shore. This was formed by laying additional ties on the stringers and placing upon these tapered jack stringers which carried the ties of the operating track.

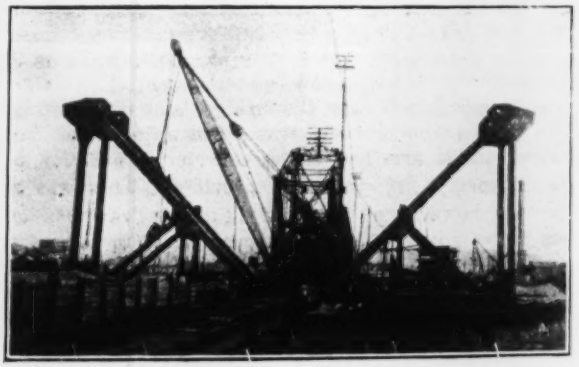
For the new 465-ft. single-track swing span, through trusses of the Warren type are used, these being 56 ft. deep at the middle and spaced 12½ ft. on centers. Floor-beam brackets carry 15½-ft. roadways outside of the trusses. The weight of the span is about 1717 tons, exclusive of the machinery, which weighs 90 tons.

Preparation for work on the new drawspan included the driving of two steel bents, distant 58 ft. and 116 ft., respectively, from the center line of the bridge, to support the first portion of the upstream arm, leaving 116 ft. to be continued as a cantilever until it reached the fender or rest pier. Each bent was composed of two steel piles connected by diagonal bracing having pin connections to allow flexibility in sinking. Each pile was of H-section, composed of three 24-in. 80-lb. I-beams, 78 ft. long, with batten plates over the flanges and having a cast-steel point about 2 ft. long.

Sinking the piles to rock through 35 ft. of sand was assisted by two water jets at 175-lb. pressure and the points were then driven about 2 in. into the solid rock by a five-ton drop hammer. Each pile carried one of the diagonal braces, attached to a pin connection near the foot. This connection permitted the brace to be held in vertical position while sinking, and then to be swung out for attachment to a pin connection at the head of the other pile. As the bents were embedded deeply in the silt, this had to be cleared away temporarily by water jets, to enable the braces to be swung across, as described. The upper half of one brace was made wide enough to allow the other brace to lie within it. A special floating piledriver had to be built to handle these 80-ft. steel piles, each weighing about 28 tons, including the bracing.

Each bent carried a 60-ft. plate girder seated upon shoes on the tops of the I-beams which formed the webs of the steel piles, the two outer beams of each pile being extended above the girder, as shown in one of the photographs. These girders were used later in the new approach. The two girders supported the first portion of the upstream arm of the draw, as noted above. The bents were braced together and to the pier by horizontal steel struts, while the first bent was braced against the pier by a timber raking strut or bent, to resist the thrust of ice and drift in the river. After completion of the work the girders were removed and also the upper parts of the diagonal braces of the bents, the steel piles being then cut off by torches at the ice line, as they were too firmly embedded to be pulled up.

To carry the first lengths of the chords on the downstream side, an inclined timber bent was seated on the footing of the pier, with its top anchored by rods built into the pier. The cap of this bent supported the first panel points of the downstream end of the span. This method of support was planned during the early part



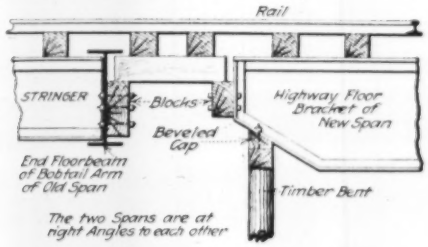
ERECTING CRANE PLACES 80-FOOT 41-TON POST OF NEW SWING SPAN; HIGHWAY PASSES THROUGH PANEL

of the work and the bent was erected, in vertical position, within the cofferdam. With the turntable center erected on the new pier, the derrick car first placed the bottom chords for the four middle panels, the outer ends of these being supported on the steel

bent and inclined timber bent for the upstream and downstream panels, respectively.

Then the panel verticals were erected, followed by the end posts extending from the turntable to the tops of the verticals. Each end post was complete in one piece 80 ft. long and weighing 41 tons. No slings were used in handling them, but hitch plates were riveted at such positions that when attached to the hoisting hook of the derrick the post would swing at approximately its normal inclined position. This facilitated setting this long and heavy member in place. Chord sections weighed from 13 to 18 tons. On the completion of the upstream arm, it served as the anchor for the downstream arm, which was built as a cantilever beyond the inclined supporting bent.

The erection of the end posts at the center of the new draw, with all those members composing the central four panels, was done with a 150-ton locomotive crane that had been built specially for the erection of the long fixed spans at the Metropolis bridge over the Ohio River. The balance of the truss was erected with a



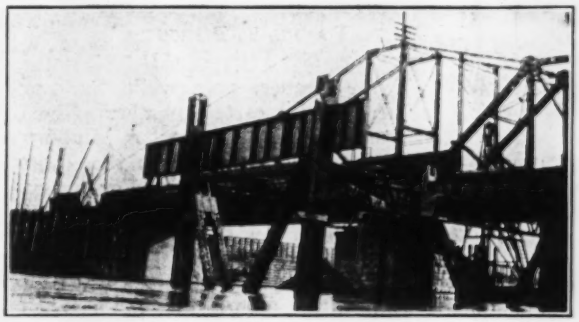
TEMPORARY TRACK CONNECTION BETWEEN THE TWO SPANS

through traveler running on the deck of the new span. This traveler was equipped with a 75-hp. electric hoist. Material was carried out to it on a track supported by the highway floor-beam brackets.

Highway traffic, during erection of the new draw, was carried on the upstream roadway of the old draw, as there was room for teams to pass under the batter posts in the upstream arm of the new span. The old roadway and the brackets on the downstream side were removed, rails being piled against the truss to counterbalance the weight of the upstream roadway. In the 136-ft. opening left by the shifting of the fixed spans for this distance, the track and the roadway were carried on timber pony bents. The main part of each bent rested on blocking on the falsework and carried the railway track, while the projecting cantilever end carried the highway. One of the views shows the crane setting these bents on the falsework.

The removal of the remaining portion of the old span, to permit of closing the new span, was effected by shifting it downstream a distance of 22 ft. This was done on 3-in. rollers laid on rails on pile falsework forming extensions of the old east pier and old center pier. The weight was about 550 tons and the span was moved by means of two nine-part tackles operated by hoists placed on each end of the old span. Both railroad and highway traffic were then operated on the track deck of the new span until the trusses were riveted, this being done to prevent any distortion in the trusses due to outside loading. With the riveting completed, the highway floor was laid on the upstream side.

For dismantling the old span, the floor-beams and bracing were first removed. Then the outer truss was

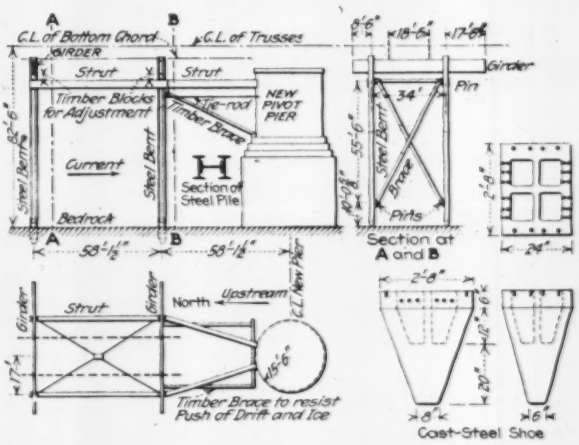


TRAVELER ON CANTILEVER CONSTRUCTION OF SWING SPAN OF ST. JOSEPH BRIDGE

moved back onto I-beam brackets attached to the new span, the latter not being required to open, as the ice still prevented river traffic. The trusses were taken apart by the aid of a derrick placed on top of the east arm of the new span.

When the old draw was rolled out and the new one closed, there was a gap of 28 ft. left between the end of the latter and the old falsework, until the old draw was taken down. Then the 80-ft. girders were rolled 28 ft. endwise to the west, and the new 60-ft. approach spans were erected.

The reconstruction of the swing span and the shifting of the fixed spans were undertaken by the American Bridge Co., under the personal supervision of K. L.



STEEL PILE IS BUILT UP OF THREE 24-INCH I-BEAMS

Strickland, division erecting manager; T. S. Melton, foreman, and A. F. McLane, resident engineer. The work was done for the St. Joseph & Grand Island Railway Co., under the direction of R. L. Huntley, chief engineer of the Union Pacific System, with H. M. Stone as resident engineer, the entire project being under the general supervision of E. E. Adams, consulting engineer of the Union Pacific System.

Immediate National Reconstruction Work in France

Improvements to Navigation of Seine and Various Canals To Be Made, and Highways and Railroads Taken in Hand

By Major Daniel T. Pierce
American Red Cross, Paris, France

FORTUNATELY for France, even while the war was going on there were a certain number of men whose duty it was to prepare for peace. A Ministry of the Liberated Regions was set up when there was scarcely any liberated region to consider. For a year before the signing of the armistice another important bureau was studying plans for the development of France's colonial possessions. At the same time, the Ministry of Public Works was considering a program of public improvements within the Republic to be undertaken immediately after the war. The Under Secretary of State, M. Cels, recently consented to outline these plans as developed up to this time.

This program of the immediate public improvements includes the enlargement and increase of port facilities, canal and road improvement, railroad reconstruction, and many noteworthy projects for increasing the utility of rivers and canals.

Projects for Which Plans Have Been Made

The following outline represents only those projects on which agreement has been reached and for which plans have already been made.

Navigation on the Seine—The work to be undertaken here consists of the reconstruction of the dams at Andressy, Méricourt, Ville-Notre-Dame, La Garenne et Poses, and the removal of the dam at Melun. At each of the waterfall locks of the Seine new locks 660 ft. in length are to be constructed.

Bridges hereafter are to have a clearance of 6 ft. above high-water level, and many tributaries to the river are to be improved and deepened. Certain parts of the navigable channels of the Seine are much in need of rectification, and this work will also be undertaken immediately. The aim is to obtain a channel depth of 15 ft., which will permit bringing up the Seine River to Paris river barges of 2400 tons and seagoing barges of 1800 tons.

North Canal—Prior to the war, extensive improvements of this important waterway were undertaken. These are to be resumed at once, with the intent of making possible the movement of barges of 600 tons instead of those of 300 tons which were the largest barges that could be handled heretofore. The improvements are now to include the repair of the canal of St. Quentin, which repair is an immediate necessity in order that coal from the Northern mines may again reach the region of Paris by canal.

The Rhine Canal—Immediate execution will be undertaken of improvements to permit the use of the canal from the Rhône to the Rhine, throughout its length, by barges of 300 tons. A navigable way from Haute Alsace and the rest of the territory will be assured, handling among other important traffic the potash of the Alsatian region. This program will be extended later on by improvements on the Rhône which is a part of the plan of internal river and harbor work.

Canals of the South—Dredging and rebuilding of towpaths to permit the use of mechanical tractors, and the reconstruction of bridges, are included in the program of improvements for the Canal of the Midi (South) and the laterals to the Garonne. The effects of these improvements will be to increase greatly the efficiency of the southern canals as a means of communication between the ocean and the Mediterranean. Some important improvements on the Loire have also been adopted for immediate execution.

Highways—In the field of road improvements there is a decided inclination to adopt other forms of construction than those which have heretofore proved satisfactory. France obtained her reputation for good roads on the basis of the service given by macadam. This, however, was before the days of war traffic and multitudinous automobiles. Some new plans for road improvement in the territory between Paris and the Marne call for granite block for considerable distances through and beyond the numerous towns and villages. Stone block represents to the Frenchman the ideal of durability under the heaviest traffic, and he is not as yet prepared to change his mind on this point.

Railroads—On the subject of railroad improvement and reconstruction, it is impossible to speak definitely, for the reason that the destruction of the war-zone railroads has been so complete that the effort is simply to put into operating condition as speedily as possible the main lines radiating northeast from Paris. Even the most important of these lines are still in a deplorable condition as to state of roadway and structures, and the available output of steel is totally inadequate to accomplish what must be done before the railroads of the war zone can be restored to pre-war conditions, much less improved as compared with their former state.

American Operation Made Good Impression

Steel bridges will be almost universally adopted and somewhat heavier rail used, for while European railroad authorities are not willing to concede the greater efficiency of the very heavy cars and locomotives preferred in the United States, a very strong impression has been made by the performance of the American equipment imported to France for war purposes, and an even greater impression has been made by the efficiency of operation that prevailed on the lines under the American Expeditionary Forces.

It is evident that the program of internal improvement which must be carried out in advance of the reconstruction of towns and villages will call for a vast amount of material and machinery which France itself cannot supply.

Correction

Several typographical errors appear in the article entitled "Tests Show High Shear in Deep Reinforced-Concrete Beams," by W. A. Slater, in *Engineering News-Record* of Feb. 27, 1919, p. 430. The test beam shown in Fig. 1 was not 26 in. deep but 36 in. as stated in the text. In the shear formula in the first column the coefficient $\frac{3}{4}$ is omitted in the vertical stirrup formula. The second formula in the same line relates to diagonal stirrups. In the second column on p. 431 the coefficient for the deflection formula is 0.0833.

Keep Accurate Costs on War-Time Fee Contract

Figures on Small Concrete Bridge Job in Which Instability and Height of War Prices Prevented Lump Sum Bidding

By Farley Gannett and J. D. Carpenter
Gannett, Seelye & Fleming, Engineers, Harrisburg, Penn.

COSTS of construction have changed so entirely during the past three years that the engineer's customary sources of information on costs are useless today, and every new evidence of costs under present conditions is exceedingly valuable. Not only were wages and material prices high, but the efficiency of labor was so low during 1918 that it was not safe to use ordinary standards of work and apply thereto the ratio of old to present wages. The construction of a small concrete bridge in Pennsylvania during the summer of 1918 is therefore interesting on account of the cost-plus-fee form of contract used, and by reason of the fact that careful cost records were kept and worked up, showing accurately actual costs at the high point in the rising prices of 1918 in this section of the country.

CONCRETE BRIDGE BUILT UNDER WAR PRICE CONDITIONS NEAR HARRISBURG, PENN.

The bridge was built for the York Haven Water and Power Co., which operates a 20,000-hp. hydro-electric power plant on the Susquehanna River 16 miles below Harrisburg, Penn. It is a two-span reinforced-concrete arch bridge across the tailrace of an adjoining paper mill, and carries a single-track railroad siding from the main line of the Northern Central R.R. to the power house. Its construction was imperative, as the old trestle which it replaced was unsafe for railroad use, and it was necessary to get heavy machinery into and out of the power house for repairs and replacement. Thus, the bridge had to be built, notwithstanding the high prices.

The contract was let for cost-plus lump-sum fee. The engineer's estimate of cost was $14,880 and the fee was fixed at $1860 or 12½%. Under the contract, if the actual cost exceeded the estimated cost for any reason except increased quantities, no increase was made in the fee, but if the actual cost was less than the estimated cost the owner and contractor shared equally in the saving. If, however, the quantities were increased or decreased, then the fee increased or decreased accordingly. The actual quantities varied so little on the total job that the final estimated cost was $15,000, as against the original estimated cost of $14,880. The actual cost of the bridge was $17,922.17, a little over $3000 more than the original estimate, but one-half of this excess was due to the raise in the labor wage per hour from 35c., when the estimate was made in April, 1918, and 40c. when the work was done. Before the work was let a lump-sum bid was requested from a contractor who was anxious to do the work, but, as his bid was $26,000, it was not awarded to him. This bid evidently included a large allowance for risk on higher wages and cost of materials, as any bid made at that time must have done. The company saved about $6000 by adopting the form of contract used instead of letting it on this lump-sum bid.

The bridge, shown in the view, has two 50-ft. spans with a rise each of 8 ft. and a middle 5-ft. pier. It is 105 ft. from face to face of abutments, 145 ft. from end to end of wing walls and 16 ft. wide out-to-out of side walls. The tracks are carried on an earth fill. The tailrace which the bridge crosses is about 100 ft. wide, with an approximate depth of 7 ft. of water therein and an average velocity of three miles per hour. The old trestle was used to transport materials across the tailrace and to support the arch centering on the new work.

The local labor was all employed in local industries, so colored labor was imported and a bunk house had to be built for them. The only machinery used was a concrete mixer and two pumps. Steam was purchased from the adjoining paper mill. The work was started May 27, 1918, and was finished Sept. 26, a total of 122 days. No great delays occurred, but the progress was slow owing to the great difficulty in getting and keeping labor.

The first work done was the excavation of the east abutment, No. 1, then the central pier and the west abutment. After the east abutment was poured, the concrete was placed in the pier and the east arch, and then the west abutment and arch were poured.

TABLE SHOWING COST DATA ON YORK HAVEN, PENN., BRIDGE, BUILT JULY-SEPTEMBER, 1918

	Bunk House	Cement Shed and Office	Travel	Excavation — Abutment 1	Excavation — Abutment 2	Cofferdams — Abutment 1	Cofferdams — Pier	Cofferdams — Abutment 2	Pumping	Small Tools
Labor at 40c. per hour	116 02	90 15	86 91	478 59	635 05	454 47	884 69	114 64	71 24	
Number of units				187 cu. yd.	500 cu. yd.	60 ft.	95 ft.			
Labor cost, unit				2 56	1 27	7 57	9 31			
Material cost	403 25	229 52				170 00	244 71	190 00	181 31	688 40
Total cost	519 27	319 67	86 91	478 59	635 05	624 47	1,129 40	304 64	252 55	688 40
Salvage	125 00	100 00								273 20
Net total cost	394 27	219 67	86 91	478 59	635 05	624 47	1,129 40	304 64	252 55	415 20
Total cost per unit				2 56	1 27	10 40	11 88			
Estimated cost	300 00	200 00		250 00	260 00	500 00	930 00	300 00	500 00	200 00
Estimated cost per unit				1 50	1 50					

	Concrete — Materials, 1:3:6 Piers and Abutments	Concrete — Mixing and Placing 1:2:4 Arches	Concrete — Mixing and Placing 1:2:4 Walls	Forms — Piers and Abutments	Forms — Arches	Forms — Walls	False-work for Arches	Reinforcing Steel	Removing Old Trestle	Taking Up and Relaying Old Track
Labor at 40c. per hour	1,181 65	751 45	417 28	511 44	476 90	987 46	780 89	598 32	215 51	62 87
Number of units	319 cu. yd.	208 cu. yd.	99 cu. yd.	319 cu. yd.	208 cu. yd.	99 cu. yd.		12.3 tons		
Labor cost per unit	3 61	3 62	4 22	1 60	2 29	9 98		48 60		
Material cost	1,347 92	1,334 33	645 90	230 66	552 81	317 61	360 89	1,119 77		
Total cost	2,529 57	2,085 78	1,063 18	742 10	1,029 71	1,305 07	1,141 78	1,718 09	215 51	62 87
Salvage	121 00	135 00	65 00	39 53	40 00	15 00	185 00	52 80		
Net total cost	2,408 57	1,950 78	998 18	701 57	989 71	1,290 07	956 78	1,665 29	215 51	62 87
Total cost per unit	7 56	9 38	10 07	2 20	4 75	13 03		139 50		
Estimated cost	2,164 50	1,903 20	759 45	360 00	945 00	1,200 00	800 00	1,235 00	200 00	75 00
Estimated cost per unit	5 55	9 15	9 15	0 92	4 54	14 46		130 00		

	Pipe Railing	Fill and Ballast	400 Ties	One No. 6 Frog	85-lb. Rail in Place	Waterproofing	Finishing Concrete	Cleaning Up	Totals
Labor at 40c. per hour	53 17	589 55		3 05	145 50	50 60	44 80	113 25	9,915 45
Number of units	290 ft.	900			4.7 tons				
Labor cost per unit	0 18	0 65			31 00				
Material cost	256 76	68 33	100 00	267 50	423.61	24 91			9,138 25
Total cost	309 93	657 88	100 00	270 55	569.11	75 51	44 80	113 25	19,073 70
Salvage									1,151 53
Net total cost	309 93	657 88	100 00	270 55	569 11	75 51	44 80	113 25	17,922 17
Total cost per unit	1 07	0 66	1 25		120 10				
Estimated cost	232 00	515 00	440 00	130 85	340 00	50 00	20 00	100 00	14,880 00
Estimated cost per unit	0 80	0 50	1 10		80 00				

It was necessary to do all excavation inside cofferdams which were mostly of double rows of timber sheet-piling, filled with clay by hand. Money was not spared in making substantial cofferdams; thus the cost of pumping was kept down. The cofferdam enclosing the east abutment was 3 ft. wide, with an average depth of 6 ft. The cofferfill was made with clay borrowed from a pit about 50 ft. distant. The pier cofferdam was also 3 ft. wide, but 10-ft. plank were used, as the water was 7 ft. deep. The wales were first framed and floated to location, where a skeleton coffer was assembled, the whole thing being supported by the old trestle and held in position in the current by wire lines. The skeleton was then sunk, sheathed and filled. Owing to the rough, rocky character of the bottom this coffer had several bad leaks, which were stopped with much trouble.

The coffer for abutment No. 2 was entirely on the bank, although rock was about 5 ft. below water level. A single row of built up tongue-and-groove sheathing was driven, making its cost considerably less than the others. The excavation here consisted of a mixture of cinders and wood scraps, which was wheeled and dumped about 100 ft. away.

One 6-in. centrifugal pump and one 6-in. siphon handled all the water coming through the cofferdams. As an indication of the items which make up the totals on the data sheet, the charge of $252.55 against pumping is distributed as follows: Rental, 88 days, at $1, $88; steam, $61.72; freight and repairs, $31.59; labor setting and moving pumps, $71.24.

After a thorough study of the materials available, it was decided that the gravel from a local deposit, which was offered at $1 per cubic yard of concrete, would be the most satisfactory. The deposit contained about 20% of clean sand under ¼-in.; 60% stone under 1 in.; 20% stone 1 to 3 in., with a few larger stones which were thrown out or used for plums in the 1:3:6 concrete. The gravel, after the sand had been removed, contained from 25% to 30% of voids. Working on the 30% basis, it was decided to use 30% of sand plus 10% of this to make a smoother mixture, or 33% of sand. In actual practice, however, this was found to make a concrete of a stony appearance and hard to work. The amount of sand was then increased to 40% of the gravel, which gave a more satisfactory mixture. A ½-yd. mixer was used, 10 revolutions being given the batch before dumping. Enough water was used to make the concrete easily workable, but no water collected in the form. The concrete was wheeled in buggies an average distance of 80 ft. The largest day's pouring was 110 cu.yd., dumping a batch about every two minutes.

The carpenters were local men, experienced in house building but not with concrete forms. The cost of forms ran high, especially in the beginning, on the 1:3:6 concrete.

The bents of the old trestle, used for falsework to support the arches, were cut below the spring line and capped. The centers were wedged 0.1 ft. above grade before concreting. During the pouring the arches settled about 0.15 ft., leaving the center 0.05 ft. low. The bases of the bents were on rock. The reinforcing steel was cut and bent on the job and placed by common labor. A clamshell was used for about 40% of the fill; the remainder was made with wheelbarrows with an average wheel of 80 feet.

The cost data show the total cost of each item, the

TABLE SHOWING UNIT PRICES PAID FOR MATERIAL.
(All prices are f. o. b. job)

Lumber, 1-in. plank	$48 00	per M
Lumber, 2-in. plank	48 00 to 51 00	per M
Lumber, 6x6 in. to 10x10 in.	51 00 to 61.00	per M
Cement	2.44	per bbl.
Sand	1.50	per ton
Gravel	1.25	per cu.yd.
Reinforcing steel—¼ in.	0.038	per lb.
85-lb. rails	75.50	per ton
1¼-in. pipe railing	.90	per ft.

labor cost, material cost, salvage and engineer's estimate. The unit costs are also shown.

The cost of excavation of abutment No. 1 was 75% above the estimate, but that in No. 2 was about 16% less than was estimated. There was, however, considerably more excavation necessary than was contemplated. The pier foundation required no excavation, as the current in the tailrace had washed the rock clean.

The costs of cofferdams, which averaged $11.30 per foot of horizontal length, were fairly near the estimate, while the pumping cost was only half what it was expected it would be. The 1:3:6 concrete in pier and abutments cost nearly 50% more than estimated, while the arch concrete came out very close to the expected cost. The reinforcing steel cost more than expected, largely because of the necessity of paying a higher price to get any steel at all.

The bridge was designed by Gannett, Seelye & Fleming, engineers, of Harrisburg, Penn., and was built under their supervision, with J. D. Carpenter as the resident engineer, by G. W. Ensign, Inc., contractors, of Harrisburg, Penn.

The cost-plus-a-fixed fee contract as illustrated by this bridge contract, wherein any saving over an agreed to probable cost is shared between the owner and the contractor, is not an entirely new form of contract, but its possibilities and equities have hardly been sufficiently appreciated. There is nothing to cause the contractor to attempt to increase costs, as in the cost-plus-a-percentage form, while there is a strong argument, in the way of additional fees, to cause him to do everything to keep costs down. There is no element of risk to the contractor, so he does not have to figure on one job to recoup losses on another. Such contracts will tend toward the employing of contractors who specialize in various forms of construction. Thus, the firm specializing in concrete bridges could be counted upon to build such bridges better and cheaper than a firm specializing in sewer work. Contractors will be employed on their professional ability rather than on their willingness to take a risk.

Under existing laws most municipalities must call for competitive bids and must let the contract to the lowest responsible bidder at a cost which is definitely set in the contract. Thus, it would not seem that much municipal work could be done under the form of contract here discussed until changes are made in the laws. Private corporations and individuals, however, may, and it is expected will, use this form of contract to their considerable advantage.

Efficient Methods of Financing Highway Bond Issues

Problem Has Many Factors Determined by Local Conditions—License Fees Work Well in States Lacking Good Roads

MANY different factors, which vary according to local conditions, enter into the problem of determining the proper method of financing highway improvements. Motor-vehicle fees may be used for highway construction or maintenance, according to the condition of the highway system in the state where they are to be applied. In states having no systems, they are particularly adapted to construction purposes, while in states where good systems exist they should probably be applied to maintenance. The above conclusions may be drawn from a paper presented by S. E. Bradt, state superintendent of highways, Illinois, and read by title before the recent convention of the American Road Builders' Association. The following is an abstract of the paper:

The provisions under which state bonds are issued by the various commonwealths are determined by the constitutions, which differ to a considerable extent. They are, however, generally uniform in the requirement that a proposition to issue bonds must be submitted in some form to a vote of the electors of the state.

In addition to complying with the constitution there are many other factors to be taken into consideration, as follows: (1) Present condition of the main roads of the state; (2) amount of mileage to be improved with state funds; (3) general type of the improvement; (4) estimated cost of the improvement; (5) assessed valuation of the state; (6) present rate of taxation; (7) all other sources from which revenue may be derived; (8) amount of bonds to be issued; (9) method of taxation to be adopted in liquidating the bonds that will be just and fair, and (10) maintenance of the roads after construction.

The consideration of these different factors will indicate immediately that the proposition is somewhat complex and that the same provisions will not be applicable to all states. In fact, if the provisions of a bond issue were worked out effectively, based upon local conditions, they would scarcely be the same in any two states. For any states with similar conditions, the Illinois plan of financing bond issues is efficient, equitable and thoroughly practicable. The plan differs from others chiefly in that, while the credit of the state is used to give the bonds stability in the market, the bonds are to be liquidated, both as to principal and interest, from the proceeds of motor-vehicle license fees. In order to bring about a sufficient revenue from this source, the fees which formerly averaged $5 per car have been increased to approximately $10 per car, which is about the amount paid now in every large state.

Every state in the Union has adopted the system of requiring that all motor vehicles be registered and a license fee paid therefor. In many of the states these fees are either in whole or in part turned back to the counties or townships and expended by local officials. It is generally conceded that, very frequently, the funds used upon the roads by local authorities are expended in such a manner as to bring no lasting benefit. In Illinois the money derived from this source has been segregated and was rapidly accumulating in the state treasury.

It is contended by some that these funds should be conserved, to be used exclusively for maintenance, leaving the improvement of the roads to be financed entirely from general taxation. It is undoubtedly true that the taxing of motor vehicles originated because of the damage which they caused to our highways. This was especially true of those stone and gravel roads planned for horse-drawn traffic, and before the days of the automobile. It is also willingly conceded, without

argument, that any state has the right to maintain its roads from motor-vehicle fees. However, Illinois has practically no improved roads to maintain. Its motor-fee collections, based upon the same schedule as other large states, will yield within two or three years from $5,000,000 to $6,000,000 annually. The demand for a connected state highway system, requiring a large amount of money, is insistent. Local and state taxes are already so high as to limit the amount that could be raised by general taxation for road improvement, to a sum which would be entirely inadequate. With these conditions in view, the State Highway department conceived the idea of using the accumulating fund as the basis for a construction bond issue.

If Illinois main roads were improved, as are the main roads of Massachusetts, then these motor fees could properly be used for maintenance; or if Illinois had already issued bonds, as has New York, and constructed a system of roads that require $4,000,000 to $5,000,000 annually for maintenance, then there probably would be no question as to the necessity for using motor fees for maintenance. However, with a very small percentage of improved roads to maintain, with no bonds outstanding, and with a growing automobile fund sufficient to pay the principal and interest on a $60,000,000 bond issue and still set aside from the same source an average of $2,500,000 for maintenance while the bonds are being liquidated, the plan to use this source of revenue appeared to be not only the most equitable, but also the most efficient method.

Whether it is equitable to pay the entire cost of any system of roads from motor-vehicle fees is often questioned. The argument is based upon the theory that road improvement benefits all of the citizens. This is readily admitted, and if the roads in the system were to be the only ones improved, the point would be well taken. In Illinois, however, the 4800 miles to be improved with the bond issue fund comprise only 5% of the total mileage of the state and will carry probably not to exceed 50% of the total traffic. The remaining 95% of the roads will be improved largely through local taxation, so that the general taxpayer will be afforded ample opportunity to pay his share.

Motor Vehicle Owners' Protection

There appears to be apprehension on the part of some people that this method of raising funds will lead to excessive taxation upon the motor vehicle. This danger seems very remote. Motor-vehicle owners today constitute a very large per cent. of the male population, and their relative number is increasing rapidly. Their numbers and influence will be sufficient to protect them against unjust and unsatisfactory legislation.

Finally, if the people are to pass favorably upon a bond issue, which involves a debt and the levying of taxes to meet this debt, then they must be convinced that the method of taxation is fair and just; and the man who is to be taxed must be convinced that he is getting value received from his outlay. In the campaign carried on for the Illinois bond issue, every motorist organization was enthusiastically for the proposition; and, so far as we know, every motor-vehicle owner was equally enthusiastic, although understanding fully that he was to pay the cost. The voters, 35 to 40% of whom are motorists, showed by giving the plan a large majority that they are convinced of its soundness for liquidating the bond issue.

In concluding, it may be stated again that the Illinois plan will not apply to every state in the Union, and is not the panacea for all the financial ills of all the states; but in states where the situation is similar to that in our state, with practically no improved roads, and with a large registration of motor vehicles, it is believed that, with some modifications, it will afford a sound, equitable and efficient method of financing.

Greater Activity Planned for the Hetch Hetchy Project

THE annual report prepared by M. M. O'Shaughnessy, city engineer of San Francisco, outlines recent progress on the Hetch Hetchy project, as well as the extent of activity for the coming year. The project is now in such condition, the report states, that $600,000 monthly can be expended efficiently in rushing it to completion if the bonds are sold so that this money is made available. During the past year the multiple-arch dam at Lake Eleanor has been completed and has for some time been serving the power house used to develop electrical energy for construction purposes. In addition to the power used on the project the city is deriving an income of $9000 per month from this temporary power plant, for electrical energy sold in San Francisco.

The most important feature of construction work now under way is the 18-mile tunnel between Early intake and the reservoir for the Moccasin Creek power house. This tunnel is now being advanced from three headings: From Priest Portal the heading has been driven in 1500 ft.; at South Fork an advance of 975 ft. has been made, and at Early intake the heading is in a little more than 1000 ft. Four additional headings will be used later in the work, one at the Priest Portal and two each from the shafts that are being sunk to the tunnel line at Big Creek and Second Garrotte.

The long tunnel is being driven on the day-labor plan at a price lower, the report states, than the engineer's estimate of $60 per lineal foot. The contractors' bids averaged about $90 per foot.

Attention will be concentrated on the long tunnel this year, as this will be the limiting factor in the completion of the first unit; i.e., the section above the Moccasin Creek power house, where a total of 66,000 hp. is to be developed under a head of 1215 ft. The longest single section of the tunnel will be the 4½-mile length between South Fork and Early intake, of which about 2000 ft. has already been completed. Six storage-battery locomotives have been purchased for hauling muck out of the tunnels, and an electric mucking machine is also being tried out. A small dam is necessary to complete the reservoir at Priest, the lower end of the long tunnel, and this, together with the penstock and power house, will be finished before the tunnel is ready for service. In case delay in financing makes it necessary to postpone work on the Hetch Hetchy dam, it would be possible to carry the Lake Eleanor dam to a greater height and to divert water from this source in addition to the natural flow of the Tuolumne River for developing power at the Moccasin Creek plant.

The fact that $1,000,000 worth of Hetch Hetchy bonds were recently sold, and an option on $8,000,000 more was taken up at the same time, is taken to mean construction work can be pushed rapidly during 1919.

Salt-Marsh Sand Clay as a Road-Building Material

Abounds in Tidal Lands in Texas—Primarily a Mixture of Epsom Salts, Gypsum, Clay and Sand—Economical to Use

ROAD surfacing with a material known as salt-sand clay, taken from the tidal lands of Aransas County, Texas, is being resorted to, with what are reported to be excellent results. The chemical analysis of this material shows that it is essentially a mixture of epsom salts, gypsum, sand and clay. When spread upon the road it hardens and produces a firm surface which has the appearance of sheet asphalt. The information following is contained in a report made to the State Highway Department of Texas by R. H. Phillips, county engineer of Aransas County.

Heretofore the material used for surfacing in this section has generally been oyster shells in various forms and conditions. At some points large shells were used, followed with a coating of finer shells mixed with sand; at other points the final coating was partially disintegrated oyster shells; while at still others the final coating consisted of small, fine shells obtained from banks thrown up on the beach.

The best surfacing locally obtainable has been what is known as "mud shell," taken from reefs in Aransas Bay. The shells, in varying sizes, from ¼ in. up, had voids filled with mud and sand. This fine silica sand, having a coating of silt which acted as a binder, solidifies under traffic and becomes a firm road surfacing. The salty nature of this material holds the moisture and keeps the road compacted.

As these reefs are accessible by wagons only at very low water or by the use of barges, sufficient material was not obtainable to provide for road-building projects. This resulted in experimenting with the material, from salt marshes, which has a composition similar to the mud sand filling in the coarser particles of the shell.

Character of the Material

The deposits drawn from are located in what are known as salt flats, at a distance anywhere from 100 to 3000 ft. from low water at the shore. In some seasons, these flats are covered with salt water for from four to six months. For the remainder of the year they dry out so that the material can be excavated.

There is considerable variation in the composition. The silt content varies in color from black to dark brown and some is even a light yellow. Although called sand clay, the sand largely predominates. The best material for road-building purposes is that which has sufficient silt to coat the grains of sand, thus filling the voids and binding the material when compacted. That considerable salt exists in this mixture is not only shown by the chemical analysis given in the accompanying table, but, as the marshes dry out in the warm weather, crystallization can be noted upon the weeds and grass.

Most of the material is taken out by hand and shoveled into wagons to be hauled to the job. There is generally a film of clean sand over the top, of thickness varying from 1 in. to 1 ft. When this is over 1 in. it is generally necessary to skim it off. Wheel-scrapers are used to advantage in many places to dig the material and haul it to the roads. It is necessary to select it so that it will have sufficient binding material. If this is not done, the road surfacing produced will quickly break up and give a condition similar to deep sand.

When first excavated, the material contains considerable water, but it drains sufficiently to be easily handled by the time it reaches the road. The original road crust is not disturbed, unless absolutely necessary, the material being spread evenly over it to bring it to the desired surface. The usual depth used is about 6 inches.

Heretofore the surfacing has been too narrow, as it is found that when wagons get off the road in passing they very soon cut through the crust at the edge and gradually destroy the entire surface. Even 16 ft. is not wide enough, and Aransas County has designated its highways to be 24 ft. wide, with shoulders not less than 2 ft. wide, to be solidly rolled to the same slope as the sand-clay surfacing. Heavy crowns are also a detriment to this type of road. The best crown is about ½ in. to 1 ft. After the surface is spread it is customary to allow the traffic to consolidate it, material being added to fill the hollows which develop as the packing proceeds.

When the road has hardened it has an appearance similar to that of sheet-asphalt pavement. Each night, even in the hottest weather, it absorbs sufficient moisture to keep it compacted and in excellent condition. One of its faults is that it has a tendency to be slippery in wet weather; when this condition is bad it may be overcome by giving the surface a coating of sand or shell. If the crowns are low, the slipperiness has not been found to give much trouble.

The annual wear is estimated at $\frac{3}{16}$ in., which is approximately 73.33 cu.yd. per mile. Add to this 50 cu.yd. per mile for filling depressions that develop under traffic, and figuring the material at 75c. per cubic yard applied, the maintenance cost for the surfacing will run about $100 per mile per year. A small motor truck with a three-blade drag will prove to be an economical means of keeping this road surface in first-class condition, it is said. It is also believed that

CHEMICAL ANALYSIS OF SAMPLE OF SALT-SAND CLAY

Substances Determined:	Per Cent
Silica	6.10
Alumina	5.10
Ferric oxide	little
Lime	13.20
Magnesia	7.95
Sodium oxide	0.53
Carbon dioxide	2.01
Sulphur trioxide	31.79
Chlorine	2.94
Loss by ignition (water and organic matter)	30.49
Total	100.11
Hypothetical Combinations:	
Water and other soluble matter	30.49
Sodium chloride	1.54
Magnesium sulphate	23.74
Calcium sulphate	27.37
Calcium carbonate	3.44
Calcium chloride	2.19
Clay	11.20
Total	99.97

an eight-ton roller would be a valuable addition to the maintenance and construction equipment.

Delivering the material upon the road costs about 34c. per cubic yard for a ½-mile haul, with the addition of about 6c. per cubic yard for each additional ½ mile. The spreading cost on the average is about 15c. per cubic yard. The information given was supplied by the Texas State Highway Department of which George A. Duren is state highway engineer.

Weights of Steel Roof Trusses by Empiric Formulas

Wide Variation in Results Obtained by Applying Rules to Practical Cases—Comparison With Estimated Weights

By R. Fleming
American Bridge Company, New York

MUCH ingenuity and study have been spent in the development of empiric formulas for determining the weights of steel roof trusses. Those given below have been brought to a common notation in which

T = weight of truss = WSD;
W = weight of truss in pounds per square foot of the horizontal projection of that portion of the roof supported by one truss;
S = span or distance between centers of supports in feet;
D = distance between centers of adjacent trusses in feet;
P = loading of truss in pounds per square feet of horizontal projection of roof;
U = allowable average direct stress in pounds per square inch (found only in the Thayer formula).

The following list includes the formulas most commonly quoted:

Cambria Steel Co., "Cambria Steel," 11th edition, 1914, for spans of 75 ft. or less.

$$T = 5SD$$

Carnegie Steel Co., "Pocket Companion," 19th edition, 1917, for loads of 40 lb. or more per square foot of ground area:

$$W = \frac{P}{40} \times \frac{1}{5}\left(\sqrt{S} + \frac{S}{8}\right)$$

Fowler, "Specifications for Steel Roofs and Buildings," 5th edition, 1909, for Fink trusses up to 200-ft. span:

$W = 0.06\ S + 0.6$ for heavy loads
$W = 0.04\ S + 0.4$ for light loads

Johnson, Bryan and Turneaure, "Modern Framed Structures," early editions: $W = S/25 + 4.0$. In the latest edition, 1916, the Ricker, 1907, formula is used for trusses resting on brick walls, and the Ketchum formula for trusses of steel-frame buildings.

Jones & Laughlin, "Standard Steel Construction," 1916:

$$W = \frac{P}{40}\left(\frac{S}{20} + \frac{12}{D}\right)$$

Ketchum, "Specifications for Steel-Frame Buildings," 3rd edition, 1916, for trusses up to 150-ft. span:

$$W = \frac{P}{45}\left(1 + \frac{S}{5\sqrt{D}}\right)$$

Maurer, "Cyclopedia of Civil Engineering," 1908:

$$W = S/25 + 1$$

Merriman, "Roofs and Bridges," 1888, 1911:

$$T = \frac{3}{4} DS\left(1 + \frac{S}{10}\right)$$

Ricker, "A Study of Roof Trusses," University of Illinois Bulletin, No. 16, August, 1907:

$$W = \frac{S}{25} + \frac{S^2}{6000}$$

Ricker, "Design and Construction of Roofs," 1912:

$$W = \frac{S}{25} + \frac{S^2}{12{,}600}$$

Thayer, "Structural Design," Vol. II, 1914:

$$T = \sqrt{\frac{PD}{U}}\,(4S^2 + 60S)$$

Trautwine, "Engineer's Pocket Book," 1911:

$$W = (0.05 \text{ to } 0.08)S$$

Tyrrell, "Mill Buildings," 1911, for roof load of 40 lb. per square foot of ground area, bays 10 to 20 ft., rafter slope 6 in. to 1 ft. and unit stresses of 12,000 compression, 15,000 tension:

$$W = \frac{S}{20} + \frac{12}{D}$$

The weights of trusses for other loadings and rafter slopes are obtained from a series of curves.

Conclusions regarding empirical formulas drawn from estimated weights of several hundred trusses may prove interesting. Three light Fink trusses resting on brick walls of 40-, 60- and 80-ft. spans, bays 16 ft., load equivalent to 40 lb. per square foot of horizontal area uniformly distributed on the top chord, roof slope 6 in. per foot, weighed 1370, 2550 and 4320 lb., respectively. The estimated weights of three trusses of the Warren type, same span and loading, but roof slope of 1 in. per foot, were 1500, 2900 and 4800 lb. The weights, according to the formulas quoted, for trusses with same spans and loading, are given in Table I.

TABLE I. WEIGHTS OF ROOF TRUSSES—16-FOOT BAYS; LOAD, 40 LB. PER SQUARE FOOT OF HORIZONTAL AREA
W = Weight per Square Foot of Area; T = Weight of Truss

Formula	40-Ft. Span		60-Ft. Span		80-Ft. Span	
	W	T	W	T	W	T
Cambria	5 00	3,200	5 00	4,800	5 00	6,400
Carnegie	2 26	1,446	3 05	2,928	3 79	4,851
Fowler	2 00	1,280	2 80	2,688	3 60	4,608
Johnson, B. & T	5 60	3,584	6 40	6,144	7 20	9,216
Jones & Laughlin	2 75	1,760	3 75	3,600	4 75	6,080
Ketchum	2 67	1,709	3 56	3,417	4 44	5,683
Maurer	2 60	1,664	3 40	3,264	4 20	5,376
Merriman	3 75	2,400	5 25	5,040	6 75	8,640
Ricker, 1907	1 87	1,197	3 00	2,880	4 27	5,466
Ricker, 1912	1 73	1,107	2 68	2,573	3 71	4,749
Thayer	2 75	1,760	3 75	3,600	4 75	6,080
Trautwine	2 00	1,280	3 00	2,880	4 00	5,120
Tyrrell	2 75	1,760	3 75	3,600	4 75	6,080

Again, three Fink trusses of the same span, spacing and slope as before, but with load of 56 lb. per square foot of horizontal projection, an increase of 40%, weighed 1670, 3200 and 5500 lb., respectively. Trusses of the Warren type, roof slope of 1 in. to 1 ft., weighed 1900, 3750 and 6000 lb. The formulas give weights for this loading as in Table II.

The variation—in some cases more than 100 per cent.—of weights obtained from the different formulas will at once be noted. The values obtained from a number of the formulas depend upon the span length alone, and are the same for all loadings. Other formulas make the weight of the truss vary directly as the load, which actual weights show to be an error. DuBois, in "The Strains in Framed Structures," gives a formula taking

TABLE II. WEIGHTS OF ROOF TRUSSES—16-FOOT BAYS; LOAD, 56 LB. PER SQUARE FOOT OF HORIZONTAL AREA

W = Weight per Square Foot of Area; T = Weight of Truss

Formula	40-Ft. Span W	40-Ft. Span T	60-Ft. Span W	60-Ft. Span T	80-Ft. Span W	80-Ft. Span T
Cambria	5 00	3,200	5 00	4,800	5 00	6,400
Carnegie	3 16	2,024	4 27	4,100	5 31	6,791
Fowler	3 00	1,920	4 20	4,032	5 40	6,912
Johnson, P. & T.	5 60	3,584	6 40	6,144	7 20	9,216
Jones & Laughlin	3 85	2,464	5 25	5,040	6 65	8,512
Ketchum	3 73	2,393	4 97	4,784	6 21	7,956
Maurer	2 60	1,664	3 40	3,264	4 20	5,376
Merriman	3 75	2,400	5 25	5,040	6 75	8,640
Ricker, 1907	1 87	1,197	3 00	2,880	4 27	5,465
Ricker, 1912	1 73	1,107	2 68	2,573	3 71	4,749
Thayer	3 26	2,082	4 44	4,259	5 62	7,193
Trautwine	2 60	1,664	3 90	3,744	5 20	6,656

into account the load, span, slope and unit stresses, but it is too cumbersome for use. Moreover, it supposes the chords to be of constant section, and neglects the web members, assuming that these two errors compensate.

In fact, as stated by Marburg, in "Framed Structures and Girders," the variables are so numerous that no formula, for the weights of roof trusses, which is at once simple, accurate and generally applicable, can be devised. Such a formula is not necessary. In calculating stresses the weight of the truss is usually so small compared with the weight of the covering, the snow and the wind, that an error in its assumption is negligible.

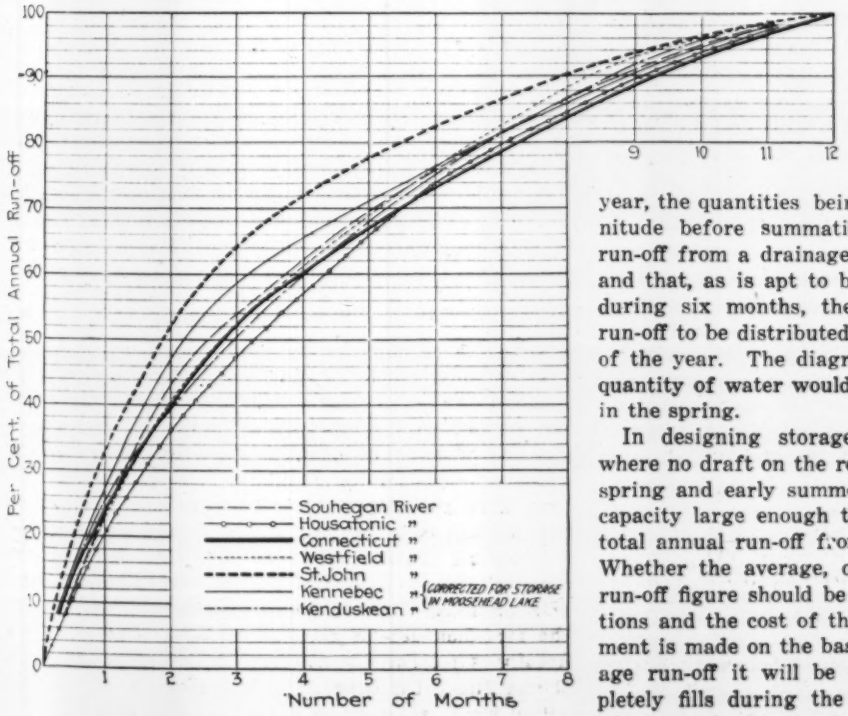
Ordinary steel roof trusses on brick walls with roof slope of 6 in. to 1 ft. and an assumed load of 800 lb. per linear foot of top chord, uniformly distributed, weigh from 30 to 75 lb. per linear foot of span for spans up to 85 ft. For less slopes the weight may be from 5 to 25% more. For different loadings the variation in weight is usually from 25 to 75% of the variation in loading. It should be noted that the personal equation of the designer and the many factors entering into the weights of roof trusses may cause a variation of 5 to 25% in the same truss.

New England Rivers Have Similar Run-Off Characteristics

In Seven Different Rivers Curves Show Half of Total Flow in Three Months and Three-Quarters in Six Months

IN THE analysis of flow records for rivers in various parts of New England the writer has found a marked similarity with respect to the quantity of water which runs off during a few months in the spring and its proportion of the total run-off for the year. The total quantity of water which passes down a river during any calendar month will naturally vary from year to year, and the month of highest run-off during one year may possibly be the month which ranks second or third highest for the next year. However, if records are available for several years so that definite conclusions can be drawn, it will be found that a certain month of the year stands preëminent as being the month which averages the highest run-off.

For the majority of New England rivers this month is April, although for some of the more northern streams May ranks the highest, and for a few rivers draining southern slopes March gives the highest run-off, the average for the one highest month being in the vicinity of 25% of the total run-off for the year. The total for the highest three months, which are usually consecutive, averages over 50% of the yearly total, while six months yield about 75% of the total. These figures are average figures based on several years' records in each case, and apply only to rivers where the flow is not regulated by the use of storage.



DISTRIBUTION OF RUN-OFF OF SEVEN NEW ENGLAND RIVERS IN A 12-MONTHS' PERIOD

The accompanying diagram shows how the cumulative run-off varies with different periods of time during the year, the quantities being arranged in order of magnitude before summation. Assuming that the total run-off from a drainage basin equals a depth of 24 in. and that, as is apt to be the case, 75% of this occurs during six months, there will remain only 6 in. of run-off to be distributed over the remaining six months of the year. The diagram shows that about the same quantity of water would go to waste during one month in the spring.

In designing storage reservoirs in New England where no draft on the reservoir is necessary during the spring and early summer, it is desirable to provide a capacity large enough to hold at least one-half of the total annual run-off from the tributary drainage area. Whether the average, or a greater than the average, run-off figure should be used depends upon local conditions and the cost of the development. If the development is made on the basis of storing one-half the average run-off it will be found that the reservoir completely fills during the spring months five years out of six, and also partially fills a second time in the autumn in some years.

ENGINEERING LITERATURE

A REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Ready Reference Books for the Engineer

BY RUTH CANAVAN

Librarian with Metcalf & Eddy, Consulting Engineers, Boston

The accumulation of data and the verification of detail, by research, are necessary and important steps toward the solution of engineering problems. Certain of the most helpful reference works for these purposes are cited in the following paragraphs.

First, there may be mentioned the two useful compilations, "Engineering Index" and "Industrial Arts Index," the former covering the years 1884 to date, and the latter 1913 to date. "Engineering News Index" gives in even more minute detail than does the "Engineering Index" references to the articles in *Engineering News* from 1874 to 1909. [The period from 1910 to the close of March, 1917, when *Engineering News* was consolidated with *Engineering Record* will soon be covered by a volume now in press.—EDITOR.] The annual indexes to "Chemical Abstracts" (1907 to date) cover in a most comprehensive manner the literature on public health, sanitation, the industrial arts, water-supply and sewerage. A cumulative index of the annual indexes for the years 1907 to 1916 has recently been issued, and offers valuable assistance to the research worker.

Other useful cumulative indexes covering professional papers, committee reports and treatises, have been published by the American Society of Civil Engineers (1867 to 1911), the New England Water-Works Association (1882 to 1915), the Society of Chemical Industry (1896 to 1915), the American Society for Testing Materials (1898 to 1912), the American Institute of Electrical Engineers (1884-1910) and the American Institute of Mining Engineers (1871-1904, 1905-1909).

ENGINEERS' HANDBOOKS AND THEIR INDEXES

In seeking information from indexes the many professional "handbooks" must not be overlooked, for most of the compilers appreciate that the value of their books depends largely upon the adequacy of their indexes. For example, a fruitless search of several hours, through textbooks on solid geometry, failed to reveal the method for computing the cubical contents of a peculiar form of ungula; whereas reference to the index of Marks' "Mechanical Engineers' Handbook" led to a prompt solution of the problem. Other handbooks popular in the engineer's library are Merriman's "American Civil Engineers' Pocket Book," Trautwine's "Civil Engineer's Pocket-Book," Frye's "Civil Engineer's Pocket Book," Kidder's "Architects' and Builders' Pocket Book," Ketchum's "Structural Engineers' Handbook," "The Standard Handbook for Electrical Engineers," Foster's "Electrical Engineers' Pocket Book," Gillette's "Handbook of Cost Data," Dana's "Handbook of Construction Plant," Gillette and Dana's "Mechanical and Electrical Cost Data," Walker's "The Building Estimator's Reference Book," and Hool and Johnson's "Concrete Engineers' Handbook."

Many of these handbooks are copiously interlarded with references to articles and reports from which citations were derived, and help set the searcher on the right path. Some of the textbooks and scientific treatises offer similar guidance, by means of footnotes or appended bibliographies.

A card list of bibliographies, arranged alphabetically by subjects, is extremely helpful, and obviates the necessity of retracing ground once covered. Such a list may be so restricted as to include only the results of one's own searches, or amplified to include such bibliographies as those published by the Carnegie Institute, the Concrete Institute, and also those appended to treatises and textbooks.

USEFUL GOVERNMENT PUBLICATIONS

Of great value in engineering research are the publications of the various branches of the United States Government, such as the "Water-Supply Papers," the bulletins and "Professional Papers" of the Geological Survey; the reports and bulletins of the United States Public Health Service; and the contributions of the several bureaus of the Department of Agriculture. Then there are also the reports of the Army engineers and their "Professional Papers," the reports of the Coast and Geodetic Survey, the Lake Survey series, the Weather Bureau reports, the bulletins of the Census Bureau and the many-shelved publications of the Patent Office. Some of these branches issue departmental indexes, but all of the United States Government publications are listed in a "Catalog of the Public Documents of the (various) Congresses, and of all departments of the Government of the United States," issued monthly by the Superintendent of Documents and annually in cumulative form. A "Check List of United States Public Documents, 1789-1909," is also useful as a means of tracing publications that are not very recent.

GUIDES TO ENGINEERING BORDERLANDS

But it is perhaps in the border lands of the other sciences, only occasionally invaded by the engineer, that guidance is most welcome. Chemistry and bacteriology are, as he knows, quite thoroughly covered by "Chemical Abstracts," but a problem sometimes confronts him which demands for its solution a more intimate knowledge of the pathological significance of some factor than the familiar reference works afford, and he resorts to the medical library. Here he may consult "The National Standard Dispensatory" or the "Pharmacopœia of the United States" (two works issued in alternate years), Stedman's "Medical Dictionary," Thorpe's "Dictionary of Applied Chemistry," "A Reference Handbook of the Medical Sciences," an encyclopedia of medicine edited by A. H. Buck in eight volumes, 1885 to 1889.

or for references to the literature on medicine he may refer to the "Index Medicus" (published by the Carnegie Institute) or to the "Quarterly Cumulative Index to Current Medical Literature," published by the American Medical Association.

Again, if the engineer is called upon as an expert witness and wishes to fortify his testimony by references to court precedents, he seeks the law library where, if he wishes the Supreme Court decisions of the various states, he consults one of the branches of the National Reporter System (viz., "The Pacific Reporter," the "Northwestern Reporter," the "Northeastern Report," etc.), or he turns to the "American Digest," which undertakes to cover all decisions in all American courts. "Ruling Case Law" and "The Lawyers' Reports Annotated" also cover cases in all courts to a limited extent, by footnote references illustrative of the precedents enumerated. Textbooks and treatises such as Wait's "Engineering and Architectural Jurisprudence," are similarly helpful. The "Federal Reporter," however, covers only United States Circuit and District Court cases. All opinions relating to public utilities, whether delivered by state commissions or the courts of the various states, are digested in "Public Utilities Reports Annotated" which, unfortunately, only dates back to 1915. Then there are such general reference works as Black's "Law Dictionary," "Words and Phrases Judicially Defined" (an eight-volume encyclopedia), Stroud's "Judicial Dictionary" (in three volumes), Williams' "Law Dictionary" and Wharton's "Law Lexicon."

It sometimes happens also that the engineer is called upon to decide architectural details not usually falling within his province. Reference may then be had to Kidder's "Architects' and Builders' Pocket-Book," to the "Handbook for Architects and Builders," published each year by the Illinois Society of Architects, or to the files of such publications as the *Architectural Review*, the *Architectural Record*, *House and Garden*, etc., some of these publications being covered by the "Industrial Arts" and "Engineering" indexes, previously mentioned.

Finally, it is useful to know of such very general reference works as "The Readers' Guide," (1901 to date), "Poole's Index" (1882 to 1906), Bartlett's "Familiar Quotations," "The American Year Book," "The International Year Book," the "Biographical Congressional Directory" (1774 to 1911), "Who's Who in America," and "Who's Who in New England," etc.

While the reference works mentioned in the foregoing paragraphs are all well-known and much used, it is hoped that their enumeration may serve to recall some source of information which otherwise might be overlooked, or to give a timely suggestion to the baffled research worker.

Barge Canal Bulletin Ceases Publication

With the January, 1919, issue, the *Barge Canal Bulletin*, which has been published monthly for 11 years under the direction of the New York State Engineer and Surveyor, discontinued publication. According to Frank M. Williams, the present state engineer, the work on the Barge Canal is so nearly completed that it does not seem worth while to continue the publication of the bulletin, which gave publicity to the progress on the various contracts and other items of interest regarding the canal work.

Johnson's Great Book Rewritten

JOHNSON'S MATERIALS OF CONSTRUCTION: Rewritten by M. O. Withey, Associate Professor of Mechanics in the University of Wisconsin, and James Aston, Metallurgist with the A. M. Byers Co. of Pittsburgh. Edited by F. E. Turneaure, Dean of the College of Engineering of the University of Wisconsin. Fifth Edition. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth: 6 x 9 in.; pp. 829; illustrated. $6.

Those who have leaned for many years on J. B. Johnson's great book, "Materials of Construction," will study this new edition with interest and profit, and are likely to adopt it as their reference manual. It is a new work, yet it follows the spirit of the original on a modernized working basis. Such prominent features of the old Johnson as the elaborate descriptive discussion of the varieties of wood, for example, have disappeared, while a 200-page section on cements and concretes properly reflects the great advance in this field made in the 22 years since the appearance of the original work.

Under the editorial guidance of F. E. Turneaure, most of the book was written by M. O. Withey. Six chapters on iron and steel, covering the production of the metal and its constitution, were written largely by J. Aston. Fatigue of metals was handled by J. B. Kommers, and corrosion of iron and steel by O. P. Watts. This collaboration brought to bear on the work a notable wealth of ability and special knowledge. The book clearly reflects this fact; it is of high rank in balance of treatment, in judicious selection of test results and other data, and in critical judgment on the many doubtful or contentious points affecting the properties and testing of materials.

To summarize the contents very briefly: After an introductory section on applied mechanics, of 47 pages, there follow 90 pages on testing machines and testing procedure. An equal space is given to wood, and about 30 pages each to stone and clay products. Cement and concrete have 220 pages, of which 20 pages are devoted to natural cement and lime. Finally, a little less than 300 pages is given to metals, by far the larger part of this space being devoted to iron and its alloys. Cast iron has 40 pages, nonferrous metals 30 pages. The three short but important closing chapters are "Effects of Temperature on Mechanical Properties," 12 pages; "Fatigue of Metals," 16 pages, and "Corrosion of Metals," 18 pages.

Considering the inevitably great bulk of a work of this kind—not far from 1000 pages—and the great and ever extending range of subjects and questions concerned, the technical reader and user of professional works finds himself placed squarely before the question whether compendious treatises can hold their own with sets of specialist books, or whether they may not after all be the preferable thing. Clearly, the compendium must abstract, give boiled-down conclusions, and, in fact, must omit much. Yet there are many features of the present work that would support the argument for the treatise, in view of the excellence with which the work has been done.

It is well remembered that Johnson's original book possessed a strength based as much on his penetrat-

ing judgment of technical questions and discussions and his prophetic vision as on his genius for gathering and selecting data—remarkable as was this latter. This quality of judgment and vision, rare as it is, and necessarily an individual gift, has in a measure a parallel in the present work. True, the author's personality is not so characteristic of the new book as of the old. The times, of course, have changed, and it may be that a greater proportion of the subjective element would not have been wholly advantageous.

Two details of the book may be cited as bearing on the question—which, by the way, is a question to be decided by each prospective user of the book according to his mental leanings. Under the heading of the reason for the tensile test of cement, the book expresses itself very distinctly in advocacy of making the compression test the standard, and states that the reasons for adhering to the tensile test are inadequate. There is obvious conviction in the comment, and a serviceable reminder that conventional methods often lag. Rather different is the attitude of another page. In the treatment of fatigue of metals, after a descriptive review of endurance tests and their results, the text passes without comment to a statement of the use of fatigue formulas in fixing working stresses; it carefully refrains from correlating the tests at high stress ranges with service under low stress ranges. Thus it leaves untouched one of the most delicate and obscure questions in the field of steel structures.

Water-Works and Their Operation

REVIEWED BY CALEB MILLS SAVILLE
Manager and Chief Engineer of the Hartford Water-Works, Hartford, Conn.

CONVEYANCE AND DISTRIBUTION OF WATER FOR WATER Supply. Aqueducts, Pipe-Lines and Distributing Systems. A Practical Treatise for Water-Works Engineers and Superintendents—By Edward Wegmann, C. E., M. Am. Soc. C. E., American Water-Works Association, New England Water-Works Association. New York: D. Van Nostrand Co. Cloth; 6 x 9; pp. 663; illustrated. $5.

Within recent years most branches of engineering literature have received valuable contributions from authors well equipped in theory and practice. Water-supply, however, seems to have been somewhat neglected. This is particularly true of practical water-works operation, which has received little attention since the appearance in 1889 of that pioneer work, "Some Details of Water-Works Construction," by William R. Billings. A notable exception is the very complete "Water-Works Handbook," by Flinn, Weston and Bogert.

Mr. Wegmann's new book is timely. It is divided into three parts: (1) Water Consumption and Hydraulic Formulas (54 pp.); (2) Design and Construction (436 pp.); (3) Maintenance and Operation (143 pp.). In addition, there are five appendixes, three of which are devoted to standard specifications for water pipes, valves and hydrants, structural and boiler steel. Following, there is a brief description of inside fire-protection systems and a reprint of the fire stream tables of the National Board of Fire Underwriters.

The first chapter is principally devoted to data on consumption and waste of water in municipalities. The next two chapters treat very briefly of the hydraulics of water-supply pipes and conduits, and are apparently intended merely for reference. The four chapters on pipes of wood, cast-iron, steel, cement and concrete contain little or no discussion of the merits of the several materials, their applicability to special conditions or their behavior under service conditions. Brief attention is given to stress in pipes due to water pressure, water hammer and temperature. The collapse of empty steel pipes is mentioned. Little is said of stress due to backfill or the care necessary in laying large pipes of comparatively brittle material.

Two chapters on submerged pipes give general descriptions of several under-water pipe crossings. In the two following chapters a number of makes of gate valves, sluice gates, pressure regulators and hydrants are illustrated and described. A discussion of the merits of the several types mentioned, without makers' names, would have added greatly to the value of the book.

The four chapters on intakes, tunnels, aqueducts and service reservoirs, are mostly descriptive and chiefly of historical value, giving little detailed information on design, construction or cost. They appear to have been compiled from reports and technical papers. The several aqueducts of the New York City water-supply are described in considerable detail, and much of the information appearing in the annual reports of the Croton Aqueduct and the Board of Water-Supply is brought together in convenient shape for reference.

In the chapter on service reservoirs, tables of cost of covered reservoirs are given. As these tables were compiled about 20 years ago by Freeman C. Coffin, some caution should be attached to their use at the present time. A very comprehensive compilation of groined-arch data by Prof. John H. Gregory is valuable for use in connection with that kind of construction. The pages given to reinforced-concrete stand-pipe construction are descriptive of many structures which have been built, and a very excellent table is given of the principal data connected therewith.

Tanks of wood and steel are described and some information is given as to design. Under fire protection, classic data are presented regarding the number and size of fire streams required, experiments of discharge and loss of head in fire hose, and a description of the method of conducting flow tests of hydrants. There are good descriptions of the high-pressure water systems in New York, Philadelphia, Baltimore and San Francisco.

Part II closes with seven pages on the various kinds of distribution systems; they give little information as to details and methods required in laying out the work.

Part III is devoted to general descriptions of water-works maintenance appurtenances and appliances. Some brief statements concerning electrolysis, abstracted mainly from reports of the late Prof. A. F. Ganz, are given. Tools and machinery used in pipe work and methods and apparatus used in waste and leakage surveys of water-works systems are next treated. Full descriptions of the various types and makes of meters in use occupy 64 pages. Mention is made of testing apparatus which is furnished by different makers, and a brief discussion is offered regarding results to be obtained. A very interesting and instructive diagram is given as to the average accuracy of ⅝-in. disc meters both new and after service. The author fails to state the conditions under which the data for constructing the curves were obtained.

The last chapter describes various instruments for

recording the height of water in reservoirs, stand-pipes and streams. Most of the standard devices are mentioned.

The book makes some mention of almost every matter connected with water-works operation. The portion on hydraulics is rather too brief for the hydraulic engineer and perhaps not sufficiently elementary for the nontechnical superintendent.

The chapters on design and construction are mostly historical or descriptive. They contain much matter gleaned from published reports on large work and from papers which have appeared from time to time in the technical press and in society transactions.

The portion of the book devoted to maintenance and operation, and especially those parts dealing with appurtenances, seem to be mainly a compendium of information contained in trade publications and advertising literature, rather than an original and distinct contribution to engineering knowledge.

While the classical work of Dexter Brackett, in his water-waste report to the Metropolitan Water Board of Massachusetts in 1903, is well and justly recognized by the author, it is to be regretted that he did not also include mention of the truly remarkable results attained in curtailing waste in this same district which recently has come about principally through the introduction of meters.

The descriptions of water-works appurtenances might well have been supplemented by discussions of the fundamentals of the different types of apparatus and of the limitations of the appliances under certain conditions. This would be of use to water-works engineers and superintendents and would enable them to separate more quickly the grain from the chaff in the salesman's argument.

The author deserves praise for enriching a rather barren field of engineering literature. Water-works superintendents and engineers should be thankful to him for bringing together in one place information concerning so many water-works devices and methods.

For Instructors of Industrial Workers

THE INSTRUCTOR—THE MAN AND THE JOB: A Hand Book for Instructors of Industrial and Vocational Subjects—By Charles R. Allen, Sometime Agent for Industrial Training for Boys and Men, Massachusetts Board of Education, and Superintendent of Instructor Training, U. S. Shipping Board, Emergency Fleet Corporation. Philadelphia and London: J. B. Lippincott Co. Cloth; 5 x 8 in.; pp. 373. $1.50.

According to C. A. Prosser, who in the Introduction states that he is well acquainted with the author, this book is the most important contribution yet made to industrial and trade training. It deals with the vital problem of the selection and training of competent instructors, and it should give employers and foremen a clear and accurate conception of the needs and possibilities of training new workers. It demonstrates that the pedagogy of industrial education has built up a definite content for courses of its own.

The author states that his main purposes are to present a handbook to instructors in industrial plants, and furnish instruction notes for instructor-training courses. The book is the result of actual experience in training over 1000 shipyard instructors. A fairly complete idea of the contents is given by the titles of the nine parts into which the book is divided: Training in the Plant; the Analysis and Classification of Trade Knowledge; Establishing an Effective Instructional Order; Putting it Over; Methods of Instruction; Lesson Planning; Instructional Management; Organization for Training in Industry; The Use of This Material in Instructor-Training Courses.

Perhaps the essence of the author's ideas can be expressed in his concept of what instruction really is, and his proposed tests of effective instruction. He maintains that telling is not instruction, drilling is not instruction, and showing is not instructing. In every case, true instruction requires thoughtful action on the part of the learner.

The book will be not alone of great practical value to vocational instructors, but also unusually suggestive for teachers of engineering in our colleges and universities, in view of the desire to profit by the war experience which is seen in many institutions.

Sewage Disposal Brought Up to Date

SEWAGE DISPOSAL—By Leonard P. Kinnicutt, late Director Department of Chemistry, and Professor of Sanitary Chemistry in the Worcester Polytechnic Institute; C.-E. A. Winslow, Professor of Public Health in the Yale School of Medicine and Curator of Public Health in the American Museum of Natural History, New York, and R. Winthrop Pratt, Consulting Engineer, M. Am. Soc. C. E. Second Edition, Rewritten. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 547; illustrated. $4.

The present thorough revision is timely, now that a resumption of building sewage-treatment works may be expected after a suspension of activities due to the war. Moreover, the subject is so complex and so many new processes, or variations and changes in old ones, are being continually made, that any book on sewage disposal soon gets out of date. The book first appeared in 1910 and was reviewed at length in this section of *Engineering News* of Nov. 17, 1910, p. 42 of the Engineering Literature Supplement, and also in *Engineering Record* of Nov. 19, 1910, p. 591.

The principal topics which have been expanded or added in the present edition are: Data on disposal by dilution, with particular reference to the investigation and conclusions of the International Joint Commission in its studies of the pollution of the Great Lakes; fine screening, notably experimental and other installations of Riensch-Wurl screens; the present status of Imhoff tanks, with special regard to foaming and related difficulties that have led some engineers to turn away from these tanks of late; the activated-sludge and the Miles-acid processes, both of which have come to the front since the first edition of this book appeared.

The book as a whole is a well-rounded presentation of the development and present status of sewage disposal.

Industrial Democracy Illustrated

MAN TO MAN: The Story of Industrial Democracy—By John Leitch. New York: B. C. Forbes Co. Cloth; 5 x 8 in.; pp. 249. $2.

So much has been written about industrial democracy in general terms that concrete examples afford a pleasing contrast. In this readable volume the author tells how he has helped to establish a number of manufacturing plants on the basis of a community of interest between employers and employees, substituting good-will for ill-will, and coöperation in production and profit for opposing class interests. In brief, the plan is to form a system of industrial government similar to our own Federal Government, with the wage earners as a lower house—all of them in small plants, and representatives in large plants. The Senate is composed of "under-executives, department heads and subforemen, accord-

ing to the size of the establishment." The cabinet consists of the executive officers of the company, with the president of the company acting as chairman.

In place of profit-sharing as commonly practiced, which the author apparently regards as a more or less arbitrary bonus system, the author has introduced at a number of plants a wage increment based "on the efficiency of production." He says: "I take the cost of a unit of production in the period preceding the introduction of industrial democracy and compare that cost with the results after democracy has gone into effect. The gain is distributed as a "collective economy dividend," half to the employees and half to the proprietors. It is paid at frequent intervals, as every two weeks, so as to make it a constantly live issue.

Text on Strength of Materials

REVIEWED BY CLYDE T. MORRIS
Civil Engineering Department, Ohio State University, Columbus, Ohio

APPLIED MECHANICS—By Charles E. Fuller, S. B., and William A. Johnston, S. B., Professors of Theoretical and Applied Mechanics, Massachusetts Institute of Technology. Vol. II.; Strength of Materials. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 556; illustrated. $3.75 net postpaid.

Considering the fact that very little space is devoted to discussion of tests or the physical properties of materials of engineering, and that centers of gravity and moments of inertia are not included, this volume of 556 pages seems unnecessarily large. In part this is due to the inclusion, at the end of each chapter, of a large number of illustrative problems, which are generally most excellent. The methods of the calculus have been employed throughout, perhaps to a greater extent than is customary, and mathematical refinements of theoretical calculation of stresses are given which are sometimes unwarranted by the assumptions made in the premises as to the properties of the materials and the conditions met with in structures. It should be noted that the authors state in the preface, "As preparation the student should have a knowledge of differential and integral calculus, the principles of statics and dynamics, and the methods of determining the centers of gravity and moments of inertia of areas and solids."

The first chapter is devoted to a discussion of the physical properties of materials, but very little is given on the results of tests. It is followed by a chapter on analysis of stress and strain, a theoretical discussion of the relations of stress intensities acting on a particle in various directions, and including the ellipse of stress. Chapters on uniform stress and uniformly varying stress and stresses in beams give the ordinary theory of flexure. In the discussion of riveted joints no mention is made of the fact that in a riveted joint the friction is the principal resisting medium and that in good work the frictional resistance between the plates is seldom overcome. The chapter on the general theory of flexure includes beams with unsymmetrical cross-sections, acted upon by oblique loads.

Combined stresses, Chapter VII, might better be discussed after Chapter IX, on columns, and should include the article in that chapter which treats of the strut or tie subjected to combined axial and lateral loading. The treatment in Chapter VII is only approximate, neglecting the effect of the deflection of the member, and might be omitted without loss.

In the chapter on arches and catenaries, after giving the equations for the reactions of arches with two hinges and without hinges, expressed in the form of integrals, the authors develop at great length the reactions for arches of uniform cross-section in which the axis is the arc of a circle. This may be good mental gymnastics for the student, but as these conditions are almost never met with in practice, and seldom attempted, it seems that the work would have been much more valuable if the axis had been made parabolic and the section variable, as in the usual case.

The last chapter, treating of reinforced-concrete beams and columns, contains the derivation of the usual formulas for simple beams, T-beams and columns, based on the straight-line assumption. The system of notation is fairly uniform throughout and conforms in the main to current usage. It would be a great help in using the book as a reference if a table of notation were given to obviate the necessity of searching through the text for the meaning of a letter or symbol.

As a textbook for class instruction, this new work may be satisfactory if supplemented with data and lectures on tests of materials, but as a reference book for the practicing engineer it does not promise to be of any great value.

The Manufacture and Cost of Liquid Steel

LIQUID STEEL: Its Manufacture and Cost—By David Carnegie, F. R. S. E., M. Inst. C. E., M. I. Mech. E., M. I. S. Inst.; Assisted by Sidney C. Gladwyn, Wh. Ex., A. M. Inst. C. E. (Bayliss Prizeman). Second Edition. New York and London: Longmans, Green and Co. Cloth; 6 x 9 in.; pp. 526; with 10 plates and 252 illustrations. $10.

This second edition of the work of a Canadian author, the first edition of which was reviewed in *Engineering News* of Aug. 8, 1913, p. 328, is unchanged except for the addition of five pages on the development of electric steel manufacture in Canada. The new matter consists of a tabular list of the electric furnaces in Canada, which were used, before the war and in 1917, mainly in the manufacture of steel for ingots or steel castings or low phosphorus pig iron. A list of companies manufacturing ferro-alloys and electrodes is added, and a typical charge for shell steel with a statement of electrode consumption concludes the new chapter.

Extending Our Foreign Trade

AMERICAN METHODS IN FOREIGN TRADE: A Guide to Export Selling Policy—By George C. Vedder. New York: McGraw-Hill Book Co., Inc. London: Hill Publishing Co., Ltd. Cloth; 5 x 8 in.; pp. 204.

The extension of American contracting and industrial business into all parts of the world has created a demand for information regarding the best methods of conducting our foreign trade. Among other broad subjects the author of this book discusses the trade policies of the principal nations of the world; the Webb-Pomerene Act and combinations in foreign trade, and a variety of export problems and details, including agents, catalogs, "Heavy Machinery in Foreign Markets," "American Banks Abroad," our merchant marine, "America's Preëminence in Salesmanship," and our tariff in relation to foreign trade.

An Omission Noted

By mischance the name of George Paaswall, New York City, was omitted as the reviewer of Dozal's "Retaining Walls," in our issue of Feb. 20, 1919, p. 390

PUBLICATIONS RECEIVED

[So far as possible the name of each publisher of books or pamphlets listed in these columns is given in each entry. If the book or pamphlet is for sale and the price is known by the editor the price is stated in each entry. Where no price is given it does not necessarily follow that the book or pamphlet can be obtained without cost. Many, but not all, of the pamphlets, however, can be obtained without cost, at least by inclosing postage. Persons who are in doubt as to the means to be pursued to obtain copies of the publications listed in these columns should apply for information to the stated publisher, or, in case of books or papers privately printed, then to the author or other persons indicated.]

THE CEMENT GUN: Its Application and Uses—By Bryan C. Collier, M. Am. Soc. C. E. Reprint from Paper Read before the Municipal Engineers of the City of New York, Dec. 23, 1918. Allentown, Penn.: Cement Gun Co., Inc. Paper; 6 x 9 in.; pp. 21; illustrated.

CEMENT IN 1917—By Ernest F. Burchard; with a Section on Concrete Ships by Robert W. Lesley. Washington, D. C.: U. S. Geological Survey. Paper; 6 x 9 in.; pp. 37; illustrated.

CHLORINATION OF WATER—By Joseph Race, F. I. C., City Bacteriologist and Chemist, Ottawa; Captain Canadian Army Hydrological Corps; Member of Committee Standard Methods of Analysis, American Water-Works Association. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 158; illustrated. $1.50.

COMPRESSED AIR PLANT: The Production, Transmission and Use of Compressed Air, with Special Reference to Mine Service—By Robert Peele, Mining Engineer and Professor of Mining in the School of Mines, Columbia University. Third Edition, Largely Rewritten. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6 x 9 in.; pp. 485; illustrated. $4.25.

In this edition some chapters "have been entirely rewritten and several have been expanded," the preface states, but the size of the volume has been kept down "by condensation and omission of old matter." The first edition, entitled "Compressed Air Plant for Mines," was reviewed favorably in *Engineering News* of Sept. 17, 1908, the second edition in *Engineering News* of Jan. 19, 1911. The book is divided into two parts: (1) Production and (2) transmission and use of compressed air. Under "Use," rock and hammer drills, coal-cutting and channeling machines, mine pumps and mine haulage and the air-lift pump are described.

DESCRIPTION OF AND GUIDE TO JASPER PARK—Ottawa, Can.: Department of the Interior. Cloth; 7 x 10 in.; pp. 97; illustrated.

Based on a photographic survey by M. P. Bridgland, Dominion land surveyor. Contains handsome halftones, descriptive text and historical notes, all edited by E. Deville, surveyor general of Canada. The park is located in Alberta.

DRAFTING ROOM METHODS, STANDARDS AND FORMS. A Reference Book for Engineering Offices and Draftsmen—By Charles D. Collins, M. Am. Soc. C. E. New York: D. Van Nostrand Co., Cloth; 6 x 9 in.; pp. 149; illustrated. $2.

Notes on drafting-room organization, arrangements; drafting standards, symbols, abbreviations; drawing sizes and methods of marking and filing drawings. Contains also miscellaneous tables of use to mechanical engineers, conversion tables for metric system, weights and measures, decimal equivalents, etc.

DRAINAGE METHODS AND FOUNDATIONS FOR COUNTY ROADS—By E. W. James, General Inspector, Vernon M. Peirce, Assistant Engineer, Charles H. Moorefield, Senior Highway Engineer. Washington, D. C.: U. S. Department of Agriculture. Bulletin No. 724. Paper; 6 x 9 in.; pp. 86; illustrated. 20c. from Superintendent of Documents.

Covers soils, design of ditches and gutters, subdrainage, foundations, loads which can be carried, etc. Contains runoff tables for the capacity of various kinds of drains, and costs of drains and foundations. It should be interesting to all highway designing engineers.

IMPROVEMENT OF THE UPPER MISSISSIPPI RIVER: A Bibliography—By Miss Winifred Gregory, Chief of the Industrial Arts Division, of the St. Paul Public Library. St. Paul, Minn.: Affiliated Engineers' Societies of Minnesota. Paper; 6 x 9 in.; pp. 22.

MANUAL OF INSPECTION AND INFORMATION FOR WEIGHTS AND MEASURES OFFICIALS—By F. S. Holbrook, Inspector of Weights and Measures, Bureau of Standards, Washington, D. C.: Bureau of Standards. Cardboard; 5 x 7 in.; pp. 246; illustrated. Free on request.

MICHIGAN STATE HIGHWAY COMMISSIONER: Seventh Biennial Report, for Two Years Ending June 30, 1918. Lansing, Mich.: State Highway Department. Cloth; 6 x 9 in.; pp. 142; illustrated.

MNEMONIC NOTATION FOR ENGINEERING FORMULAE: Report of the Science Committee of the Concrete Institute; with Explanatory Notes by E. Flander Etchells. New York: Spon & Chamberlain. London: E. & F. N. Spon, Ltd. Cloth; 6 x 9 in.; pp. 116; illustrated. $2.50.

Radical changes in algebraic symbols and related elements of formula language are proposed in this report. The "mnemonic" feature is illustrated by the author's advocacy of B for bending moment. Some of the innovations are of typographical nature and call for unusual fonts of type. Others are the substitution of new letters for quantity symbols now commonly used. The report has a number of appendixes, of which one, entitled "The Inter-Relationship of Nomenology and Symbology," indicates the author's viewpoint. Incidentally, the word "milal" is used as the name of the 1000-lb. unit.

MODEL MAKING: Including Workshop Practice, Design and Construction of Models; A Practical Treatise for the Amateur and Professional Mechanic, Giving Instructions on the Various Processes and Operations Involved in Model Making and the Actual Construction of Numerous Models, Including Steam Engines, Speed Boats, Guns, Locomotives, Cranes, etc. Edited by Raymond Francis Yates, Editor of Everyday Engineering Magazine. New York: The Norman W. Henley Publishing Co. Cloth; 6 x 9 in.; pp. 390; illustrated. $3.

A book for boys and men, this little work is likely to prove inspiring, helpful and instructive. Preliminary to the description of the making of various special models—of engines, hoists, boilers, boats, locomotives, and the like—there are very good chapters on the right kind of workshop, on lathes and drills, on soldering, on hardening and tempering, on the use of abrasives, and on pattern making and electroplating.

MUNICIPAL FINANCES: Report, Mar. 31, 1918; Statistics of Cities and Towns of Iowa. Frank S. Shaw, Auditor of State. Des Moines, Iowa: State Auditor. Cloth, 6 x 9 in.; pp. 294.

Among the tables of particular interest to municipal engineers is one giving the salaries of department heads in Iowa cities and towns. The report covers all the 105 cities of the state and 719 of the 789 towns listed.

THE NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES: A Permanent Association of Organizations in the Construction Industries and Professions, Succeeding the Temporary Organization Formed July 15, 1918, under the Auspices of the Chamber of Commerce of the United States of America. Philadelphia, Penn.: The Federation. Paper; 8 x 11 in.; pp. 23.

NEW HAMPSHIRE STATE HIGHWAY DEPARTMENT. Seventh Biennial Report Relative to Highway Improvement. Concord, N. H.: The Department. Paper; 6 x 9 in.; pp. 214; illustrated.

NOTE ON VARIOUS TYPES OF EXTENSOMETERS FOR TESTING BRIDGE GIRDERS—By H. S. Sales. Simla, India: Railway Board of India. Paper; 8 x 13 in.; pp. 16; illustrated.

PEARSON'S PATENT PERMANENT WAY—By J. D. Pearson, B.A., B.E., M. Inst. C. E., Executive Engineer, B., B. & C.I. Ry. Simla, India: Railway Board of India. Paper; 8 x 13 in.; pp. 4; illustrated.

Ties are dispensed with, each rail being riveted or bolted to a flat longitudinal plate 12 in. wide. Gage is maintained by tie bars. A 400-ft. length of this track has been laid.

A PLAN FOR SHOP SAFETY, SANITATION AND HEALTH ORGANIZATION—Issued Under the Direction of the Industrial Commission, John Mitchell, chairman. Albany, N. Y.: New York State Department of Labor. Paper; 6 x 9 in.; pp. 32.

A PORTABLE CUBIC-FOOT STANDARD FOR GAS—By M. F. Stillman, Assistant Physicist, Bureau of Standards. Washington, D. C.: Bureau of Standards. Paper; 7 x 10 in.; pp. 13; illustrated. Free on request.

PROBLEM OF RECONSTRUCTION WITH RESPECT TO URBAN TRANSPORTATION—By Delos F. Wilcox, Ph.D. Reprinted from *National Municipal Review*, January, 1919. Elmhurst, New York City: The Author. Paper; 7 x 10 in.; pp. 15.

THE RELATIVE CORROSION OF CAST-IRON, WROUGHT-IRON AND STEEL PIPE IN HOUSE-DRAINAGE SYSTEMS—By William Paul Gerhard, M. Am. Soc. M. E. New York: The Author, 736 W. 181st St. Paper; 6 x 9 in.; pp. 34; illustrated. 34c., postpaid.

REPORT ON THE BEST PROCESS AND PLANT FOR TREATING RAILWAY SLEEPERS—By C. D. Dove Wilson. Simla, India: Railway Board of India. Paper; 8 x 13 in.; pp. 12; illustrated.

This deals only with English practice in creosoting ties, including the full-cell process, the Ruping empty-cell process and the Boulton boiling process.

RHODE ISLAND STATE BOARD OF PUBLIC ROADS: Seventeenth Annual Report. Providence, R. I. Paper; 6 x 9 in.; pp. 79; illustrated.

SANITATION IN EMERGENCY SHIPYARDS—By W. L. Stevenson, Late Sanitary Engineer, Department of Health and Sanitation, U. S. Shipping Board, Emergency Fleet Corporation. Reprinted from the *Journal* of the Boston Society of Civil Engineers, January, 1919. Address the author, care Pennsylvania State Department of Health, Harrisburg, Penn. Paper; 6 x 9 in.; pp. 18; illustrated.

SPECIAL WATER POWER INVESTIGATION, STATE OF MAINE, 1918. Augusta, Me.: Public Utilities Commission. Paper; 6 x 9 in.; pp. 420; illustrated.

STEAM ENGINE TROUBLES: A Practical Treatise for the Engineer, Telling How to Locate and Remedy Troubles with a Steam Engine—By H. Hamkens, Mechanical Engineer. New York: The Norman W. Henley Publishing Co. Cloth; 5 x 8 in.; pp. 284; illustrated. $2.50.

A revision and extension of a series of articles originally published in *Power*.

STRUCTURAL STEEL FOR SHIPS: Standard Practice Recommended by American Steel Makers as Adopted by the Emergency Fleet Corporation. Revised Nov. 20, 1918. Pittsburgh, Penn.: Carnegie Steel Co. Paper; 5 x 8 in.; pp. 60; illustrated.

THE SUDD REGION OF THE WHITE NILE AND THE HARNESSING OF ITS WATERS—By Sir William Willcocks, K.C.M.G., Late Director General of Reservoir Projects, Cairo, and Director General of Irrigation Projects, Bagdad, and John Wells, Consulting Engineer and Managing Engineer Egyptian Government Research Work. Cairo, Egypt: The Authors. Paper; 7 x 10 in.; pp. 30; illustrated.

WATER CONSERVATION AND IRRIGATION COMMISSION REPORT, NEW SOUTH WALES, 1918. Sydney, Australia: The Commission. Paper; 8 x 13 in.; pp. 29.

WISCONSIN HIGHWAY COMMISSION: Fourth Biennial Report Showing State-Aid Highway Operations, 1916-18. Madison, Wis.: The Commission. Paper; 6 x 9 in.; pp. 358; illustrated.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Return Highway Engineers from France

Sir—You are probably familiar with the literature and advertising which were sent out in the recruiting of the 23rd Engineers. It was represented that this regiment was to be a special road-building regiment made up of experienced construction men—engineers, contractors, superintendents, and all classes of experienced men doing this work.

This regiment probably did a great deal of good work in France, during the year preceding the signing of the armistice. I feel now that it is needed here in the United States more than it is in France. I had a letter from my brother who is in the regiment, written Jan. 27, saying that they were building macadam roads in France on that date, and had been since the armistice was signed.

I do not believe it fair or honest to the members of this regiment to keep them there any longer. Some of the boys who were getting from $150 to $200 per month as foremen and superintendents are working over there with picks and shovels at $33 per month. They were willing and anxious to make this sacrifice during the prosecution of the war, but now that it is over I do not believe that they are willing to do this work, but are anxious to get back here, and I know that we need them. Is there not some way that we can get this regiment returned home?

The Government is urging the building of roads, pavements and buildings, and construction of all kinds, and there is going to be a great amount of this class of work started this month. The 5300 members of the 23rd Engineers, being experienced men, should be here now to take advantage of the opportunities that are opening up.

J. K. SHINN.

Independence, Kan.

Injustice to Engineers Returning from Army

Sir—I beg leave to air a grouch against the engineering profession. From time to time you have printed articles regarding the underpaid younger members of the profession, but there is still a lot left unsaid.

Take, for instance, the case of the young engineers with a college education and a few years' experience who have joined the colors. Some entered engineer training camps, others enlisted in engineer regiments, and quite a few, desiring a more personal method of getting at the Hun, entered the line. For the majority of these men, their engineering education proved almost a passport to a commission, and for once at least the value of engineering training was considered at its true worth.

These men, many of whom were employed on construction work long since completed, now stand on the verge of demobilization, and few of them have their former positions open to them. Naturally, most of those who are seeking employment turn their efforts first toward the field of their profession; but what do they find? If there is any demand at all for their services, they are offered positions involving considerable responsibility at the same wage (or less) than a day laborer can demand.

Discouraged, the thought is bound to sink home: "Just what is the incentive to take up their profession where they left off?" Why should a man, well educated and reared in a comfortable home, give up almost everything in life that he has learned to consider worth while, and the best years of his life, to an existence comprised of construction camps and cheap boarding houses, deprived of the society of intellectual equals other than his companions in exile, as many of us have experienced, at less salary than that of a labor foreman in charge of a dozen or so foreign laborers? Why should a man who has spent four years or more at college be unable to demand as much pay as a man who has served an apprenticeship as a plumber, boilermaker, or the like? Take the more intimate side of his life—a man's thoughts usually turn to marriage sooner or later—can an engineer marry a girl of his own station in life, accustomed to the comforts of home and perhaps a few of the luxuries of life, and hope for real happiness with several years of bitter struggle and hand-to-mouth existence ahead? Ought he not be given some slight recompense in the way of salary for the lack of opportunity to establish a home?

The profession blames the public for failure to recognize the engineer's true value; but is the public altogether to blame? Isn't it largely the fault of the engineers themselves? Why should anyone be willing o pay the engineer in charge a fair salary when he himself hires an efficient assistant, often as good as himself, at a mere pittance, and so on down the line? It seems to me that if engineers would quit blaming the public for lack of recognition of their worth, and each and every one would try to get those under him an increase in pay commensurate with their ability, it would soon raise the scale of wages of the whole profession.

A. H. ARMSTRONG,
First Lieutenant, United States Marine Corps.
Marine Barracks, Quantico, Va.

Federation of American Engineering Societies Proposed

Sir—The question of consolidation of the engineering profession in America, ordinarily one of importance, has been brought to a head by the war and the reconstruction following it, and there is at the present time much comment upon the activities and policies of the engineering societies which are depended upon to effect the consolidation. The main object is, of course, the public recognition of the engineer, which the engineer feels has not been forthcoming so far, but which he thinks could be materially furthered by the consolidation.

There was a time when the doctors were not recognized any more than the engineers are now, but, thanks

mainly to the effective work of the American Medical Association, that condition is now past, whilst the profession's interests are guarded by a powerful organization, irrespective of whether its members are graduates of a particular university, or of a college of physicians or one of surgeons. Can this be duplicated in the engineering profession?

Influential engineers seriously considering this matter would like to see some kind of a federation of the engineering societies, with some such body as a general engineering board of direction at the head and representative of all. They would like to see a plan put through whereby each qualified engineer would be enrolled as a member of one huge organization, controlled and administered by such a board. Such a development in engineering organizations is a sweeping one, and there is very little sight of it "up the pike" so far.

Who has the scheme which will effectually coördinate all professional engineers, however specialized, and yet exclude all who are deemed insufficiently qualified, and which will not restrict the main activities of the engineering institutions but will embrace them all? Who would like to suggest a democratic Federation of American Engineering Societies?

Who, having suggested such a federation, wants to differentiate the existing organizations so that they may be assigned to their proper places in it? If this much could be worked up as a starter—just to see where we should arrive—and some publicity given to the results, then it might serve to help in many ways. In the first place, new societies might stop long enough in the framing of their charters to consider where they would stand and what little reservation they would fill out in such a federation; this might tend to reduce the number of organizations—a good thing if such reduction means simplification and tends toward better organization and control. In the second place, the older organizations who have, without exception, endeavored to "spread themselves all over the map" might also stop to consider whether "safeguarding the interests of the engineer" can be taken care of by the same organization and the same set of workers in it (for there is always a set of workers) as advance the purely educational side of the profession. In other words—none of which is meant in criticism—the organizations would begin to consider how they could all hold one another's hands without stepping on one another's toes.

All concerned would then probably arrive at an opinion that such bodies as the educational and technical societies—admirable as such—cannot properly take up economic matters concerning the financial position of their members; that such bodies as the local engineering societies should get in on the ground floor in the advancement of public affairs in state or community, and that the federation might try its hand at the national affairs.

The problem is a big one—the biggest the organizations have to face—and if a solution is attempted some organizations will stay up and some will go down. Responsible engineers would say, however, that the attempt is worth while if it only succeeds in inaugurating a legitimate movement which has the goodwill of the majority, and in which all honest organizations can fearlessly participate in the endeavor to create something for the good of all. Such a movement has not yet appeared, although some think they see it in the Engineering Council—which is no criticism of the Engineering Council. The council from the start has, however, represented the few and not the many—there are now five organizations in it out of possibly one or two hundred organizations that are eligible. Its work is being done in good faith; but the large number of societies not yet included, and not provided for in the charter of the council at the outset, would say that the organization, not representing them, is undemocratic. Whether it is or not, they would say it isn't, and so what is the use?

Mr. Flinn, secretary of the council, speaking recently at a general meeting of Canadian engineers, said that for evident reasons it would be impracticable for the Engineering Institute (of Canada) to become a member of the Engineering Council on the same basis as the other five societies, but international coöperation would be desirable, and he would suggest that the Engineering Institute and the Engineering Council should appoint a committee (another committee!) for interchange of good-fellowship and for active coöperation.

Better, then, regard the Engineering Council as what it is—a committee, a joint committee of the four national engineering societies known as the Founder Societies and one or two others, with a program of activities suggested by the participation of engineers in public affairs. It is not, and cannot become, unless its constitution is radically changed, an organization to represent all engineers, which is what we want.

The Engineering Council is apparently the only thing of its kind now existing in this country, and is the only coöperative movement representing a number of the engineering organizations—and, incidentally, it does represent probably 30,000 or 40,000 engineers. But the point is, it does not represent the organized engineering profession. These statements are not in criticism of it, but are merely to show that in this movement there is no sign of such a thing as a Federation of American Engineering Societies would perhaps provide.

WILLIAM E. BULLOCK.
Assistant Secretary, American Society
of Mechanical Engineers.
New York.

Giving Credit Where Credit Is Due

Sir—In your issue of Feb. 20, 1919, p. 394, is a letter from C. E. Drayer, secretary of the American Association of Engineers, in which, among other things, he says "the efforts of the American Association to raise the pay of the technical engineer in railroad employ have been successful, much beyond early hopes." This is very encouraging and is fine work, but is the A.A.E. justified in taking all the credit to itself, as is implied by the tone of Mr. Drayer's remarks?

When it was found that the Railroad Administration had overlooked the technical engineer in the matter of increased compensation, both the A.A.E. and the Engineering Council brought the question to the attention of the administration, with the request that justice be done. Now, the Engineering Council represents six national technical organizations, with a combined membership of about 40,000 engineers, and the life history of the oldest of these member societies dates back nearly 70 years. The A.A.E., on the other hand, represents barely 3000 engineers and the years of its

life can be counted on the fingers of one hand. It is a fair question to ask, therefore, which of the two communications carried more weight with the Railroad Administration?

I am thoroughly in sympathy with the aims and work of the A.A.E. It has accomplished wonders in a short time. There seems to be a tendency among its officers and members, however, to claim for the association rather too much of the credit for results obtained, and at the expense of the old founder societies. In fact, the latter are usually ignored or destructively criticized. This attitude I have noticed in the official organ, *The Monad*, and in individual members of my acquaintance. Does this not appear to be a wrong attitude to take? Does it not tend toward bad feeling and disintegration, rather than toward enthusiasm and coöperation in the profession? The latter condition is an avowed aim of the A.A.E., I believe. Again, such an attitude is not warranted in view of the fine results recently achieved by that offspring of the founder societies, namely, the Engineering Council.

Granted that the founder societies needed prodding and awakening, and that they have been asleep to many of their opportunities and responsibilities; granted, too, that the A.A.E. was instrumental in the work of revival, still, the most unsparing critics and the most vehement prodders have been and are, themselves, members of these identical societies. So the A.A.E., after all, is only one of many instruments used in the good work.

Let me mention a few of the resultful and potential activities recently undertaken by the Engineering Council: The splendid service rendered to the Government, the nation, and the profession, during the war, by the American Engineering Service; the good work now being done by the Engineering Societies' Employment Bureau; the recent organizing of the National Service Committee of the Engineering Council at Washington, with its aim of disinterested usefulness to the nation and the profession; the formation by the Am. Soc. C. E. of its Committee on Development, from which great things are expected in the way of solidifying and otherwise helping the profession; the thorough fashion in which the council is now tackling the question of the licensing of engineers; the recent efforts to induce municipal, state and Federal officials to carry forward public works to help relieve the present industrial situation; the letter to President Wilson urging the appointment of engineers to the Commission on Reconstruction (the President's reply is aptly commented on in a letter by M. S. Parker in *Engineering News-Record* of Feb. 20, 1919, p. 395); the attempts to get justice for the railroad technical engineers, as noted above; and, finally, the action taken with regard to the unjust discharge of nearly 400 engineers of the Public Service Commission, New York.

In connection with this last, I am aware that *Engineering News-Record* in an editorial entitled "Will New York Engineers Fail in Their Civic Duty?" waxed indignant because the council at first refrained from action until the case had been presented to it in a "formal communication." A perfectly correct stand to take, was it not? Certainly, as responsible a body as the council cannot take action merely on the evidence of newspaper headlines and street gossip. Anyway, it eventually acted, and results quickly followed.

It must be recognized that the A. A. E. is doing fine work in its attempts to solve the perplexing "reconstruction" problems of the engineering profession. The task is appallingly large and complex. Does it not seem, however, that the objective of all our efforts should be a merger of the existing engineering and technical societies into one main national organization, with two distinct functional divisions; viz., the scientific or technical, and the economic or service? Affiliated district chapters in all parts of the country could take care of local requirements and be used for social and scientific purposes, as are the numerous independent engineers' clubs under the present disorganized conditions.

Some such bold and comprehensive scheme as this, through which action could be unified, is necessary in order to secure the rights of the profession and to achieve its solidarity and the public recognition to which it is entitled.

E. A. VAN DEUSEN,
Charlotte, N. C. Assoc. M. Am. Soc. C. E.

Increase in Prices Due to Labor

Sir—I have read with much interest the article by O. M. Fox, in your Feb. 20 issue, p. 369, on "Material Prices Halt Chicago Building Operations." From a reading of this article, one would naturally blame the manufacturer for the high cost of material, but the writer has overlooked one vital feature which throws the increase in cost not upon the manufacturer, but upon the labor he employs.

In 1913 boiler makers were paid 42½c. and 45c. an hour, and the cost of a fabricated tank, steel, rivets and labor, overhead and margin, was 5c. a pound. Today, with labor 70c. an hour, the labor cost of building this tank is 10c. a pound, no steel, no overhead, no margin. In other words, if steel cost $20 a ton less than the price now being paid, it would make no material difference in the price for which a manufacturer could sell his tanks; and there will be no material reduction in tank prices until labor is willing to do a day's work for the high price they are paid.

We believe that the case cited above is parallel in almost any line of manufacture, such as engines, generators, pumps, and the manufacture and fabrication of steel structures or any other item where labor enters materially into the cost.

F. F. VATER,
President, Power Plant Specialty Company.
Chicago, Ill.

Safety of Workmen Should Receive First Consideration

Sir—The article published in your issue of Feb. 27, 1919, p. 443, with the title "Awning Reduces Lost Time by Hiding Movements of Derrick," has been read by me with much interest.

Without doubt the principle of avoiding the distraction of workmen's attention from their duties is correct and wise, but in applying it in this particular case a more important principle has been lost sight of completely. The carpenters who "stopped work every time the derrick swung its load and stood ready to dodge if it let go" had some justification for their evident fear. The placing of the awning did not remove this

fear, and I question very much whether the placing of the awning effected any saving in the long run.

The correct procedure here should have been to avoid even the appearance of danger. The most striking point in the article referred to is that the thought of safety for the workmen does not seem to have entered the mind of the man in charge. This is surprising, considering the attention paid to the matter of safety in these days.

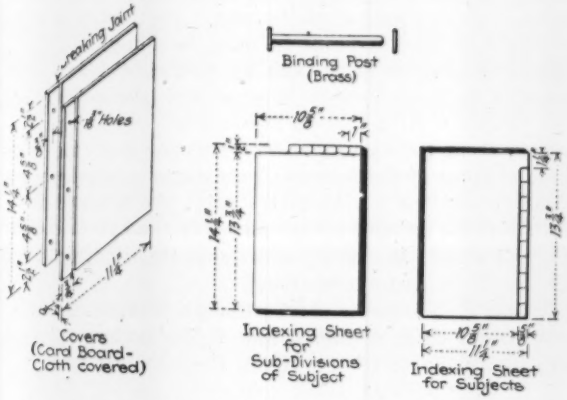
J. JAY DUNN.

Ellwood City, Penn.

Engineer's Data File Is Compact and Convenient

Sir—The saying, "He who reads and throws away, may live to rue that very day," once heard is easily remembered, especially when you are looking for that article on a certain subject which you know you had once seen, but cannot recall where or what you did with it. It is the purpose of this article to describe a filing system used by the writer by which it is easy to locate any article deemed of sufficient importance at the time of reading possibly to make it desirable to retain it for later reference.

All articles taken from the various periodicals on subjects of interest, and sometimes the bulletins on various engineering projects, are filed, if not of too bulky a nature, by means of a pair of stiff cardboard covers, brass binding posts and paper separating or indexing sheets, as shown in the sketches. The binding



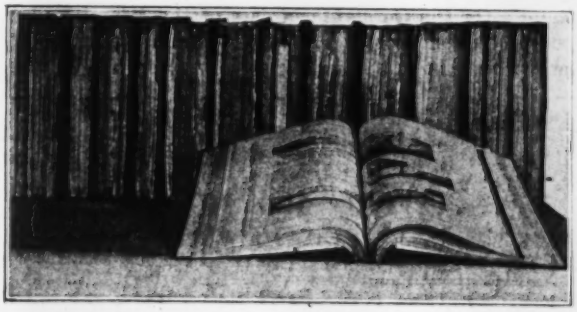
DETAILS OF CARDBOARD COVERS FOR DATA FILE

posts can be purchased from an office outfitter at about 3c. each for the 4-in. size, which is the longest made commercially. The covers can be made up for about 80c. per pair by a book-binding establishment, where the paper for the separating sheets can also be purchased and later cut as required. The size of the covers shown can be used for filing articles taken from any of the periodicals published today.

The most important part of the filing system, as regards convenience, is the separating or indexing sheets, which are bound together with the articles, according to subjects, in alphabetical order. There are subject headings at both the right-hand side and at the top of the volume. The right-hand notations indicate the subject proper, while the top notations indicate the subdivisions of the subject. For example, suppose the subject of boilers is to be referred to, the subdivisions are construction, operation, land types, testing, marine types, etc., the subdivisions being added as the articles are procured.

Articles should be removed from periodicals by pulling out the wire binders with a pair of pliers, instead of cutting the article out with a knife, which very seldom leaves a sufficient margin for filing by this method.

It can readily be seen that a system of this kind can be made very extensive when taken as a whole, yet very simple, due to the fact that all articles that are pos-



ARTICLE FILE AT ACCUMULATED IN TEN YEARS

sessed on a certain subject are all in one place, in convenient form, instead of all over the library, as they would be if put in permanently bound volumes. The photograph shows to what proportions the writer's article file has attained in 10 years.

Generally, articles are not filed as soon as they are received, due to the amount of labor involved in opening up the volumes, but are laid away until a sufficient number have accumulated to make their insertion advisable, the memory being relied upon in the meantime, or entries being made in a card index. All persons who file various data should maintain a card index in which should be listed all books, papers, etc., in the library. The card index, although not absolutely necessary for this type of article file, is nevertheless a good standby.

For the filing of catalogs, pamphlets, books, etc., the writer uses a system of numbers, combined with the first letters of the alphabet, as follows: All books, etc., are filed in four divisions of size, according to height, each size having a certain letter—i.e., those over 10 in. high are designated by the letter A, over 9 in. high and up to 10 in., by the letter B, 8 in. high and up to 9 in. by the letter C, under 8 in. high by the letter D. Filing is then done by the book or pamphlet taking the next consecutive number according to the division to which it belongs, this number being put on the outside so as to be easily seen. A standard sectional book case is used for filing; it contains also a drawer for the card index.

A. H. MYERS,
Chief Inspector, Marine Department, Wellman-Seaver-Morgan Company.
Akron, Ohio.

Overhead Charge Between City Departments

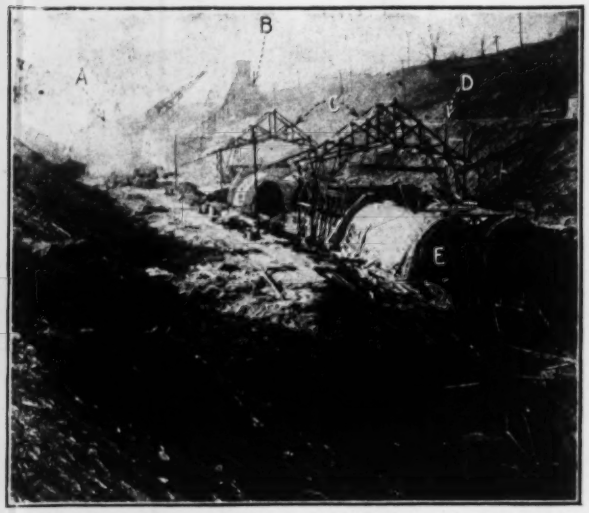
Work done by one department of the City of Detroit for another is paid for at cost plus a percentage for superintendence and overhead expense. The Departments of Public Works and of Parks and Boulevards add 15%, the Public Lighting Commission 10% and the Board of Water Commissioners 20 per cent.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Traveler Carries Concreting Chute and Forms for Conduit

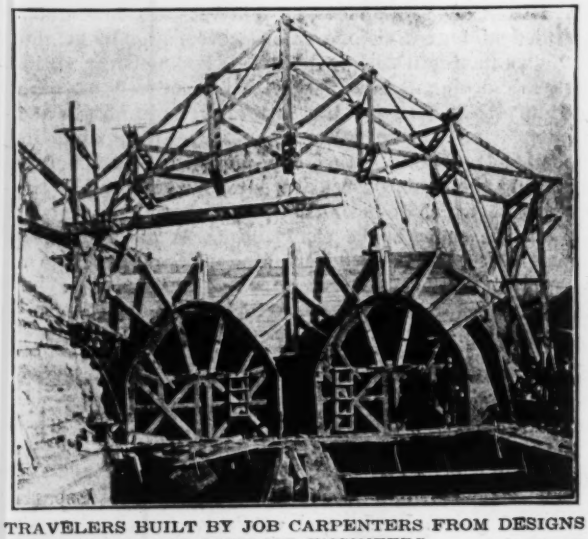
TRAVELERS carry the concreting chutes and handle the outside arch forms, in concreting the outlet conduits for the Germantown dam of the Miami Valley flood-protection works. As the conduit structure at Germantown is at the foot of a very steep hill, it was



TRAVELERS SHIFT CONCRETING CHUTES AND FORMS FROM SECTION COMPLETED TO SECTION BEING BUILT

A. Dragline digging trench for conduits. B. Gravel-washing and concrete-mixing plant. C. Travelers handling forms and chutes. D. Truck for concrete cars.

possible to place a track from the concrete mixer on the hillside well above the level of the highest concrete. From this track the concrete is conveyed to the different



TRAVELERS BUILT BY JOB CARPENTERS FROM DESIGNS OF DISTRICT ENGINEERS

Other Articles in This Issue of Interest to Contractors:

Building a Floating Dry Dock in Well Laid Out Yard — Page 552

Army Trade Skill Tests Applicable in Construction — Page 554

The Construction Division of Our Army: Operation and Maintenance Functions — Page 562

Immediate National Reconstruction Work in France — Page 570

Keep Accurate Costs on War-Time Fee Contract — Page 571

parts of the structure by means of steel chutes suspended from travelers each consisting of two trusses with the necessary supporting columns and braces. These travelers move on a track consisting of a single line of rail placed along each side of the structure.

The method of operation is as follows: When the outside arch forms are to be moved ahead, the chute, which is suspended from the traveler by block and tackle, is drawn up out of the way. The forms, which are made in three sections for easy handling, are then lifted, one section at a time by means of block and tackle, a sufficient height to pass over the collars of the conduit section already constructed, and are suspended from the traveler. The traveler carrying the three sections of the forms and the chute is then moved ahead to the new position, the forms are lowered into place, and the traveler is then moved to the best position for concreting the section and the chute is lowered to the proper angle for concreting.

Arthur E. Morgan is chief engineer, Charles H. Paul is assistant chief engineer, and C. H. Locher is construction manager of the Miami Conservancy District.

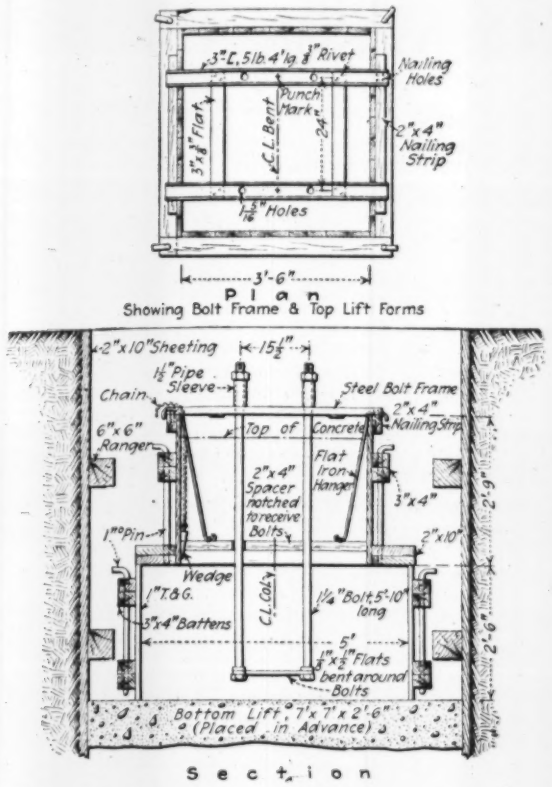
Anchor Bolts Held in Correct Position While Concreting Footings

BY A. P. ROSCOE

Ozone Park, New York

AS THE result of experience in the construction of about a thousand column foundations for an elevated railroad in New York City, there was developed a special bolt frame and templet for facilitating the work of setting anchor bolts to exact line and grade and holding them in position while concrete was placed for the footings.

The form panels for the two upper lifts were assembled on the completed bottom lift, placed a day or two previously. The 1-in. pins used to fasten the forms were found to be difficult to remove after the concreting was done, and were later replaced by tapered pins



DETAILS OF ANCHOR BOLT TEMPLET FOR FOOTINGS OF COLUMNS

of rectangular section fitting into metal-bushed, circular holes in the battens. The completed form was then carefully braced and wedged against the rangers and sheetings so as to prevent lateral movement and to counteract any tendency of the forms to rise because of the pressure of the concrete.

The bolt frame, or templet, constructed of 3-in. channels and 3 x ⅜-in. flats, was accurately drilled for the four 1¼-in. anchor bolts. These frames were light and sturdy and were in good condition when the job was finished. The frame was laid on top of the form and was accurately set by a field party using the center punch marks on the frame; when set they were nailed in place through the nailing holes shown near the ends of the channels. The bolts were set and adjusted to grade by means of the sleeves and nuts shown. This afforded a quick and accurate method of setting the bolts. To hold the anchor bolts in place against the impact of concrete being placed, and to prevent their movement by workmen spading the concrete, they were fastened together at the bottom with ⅛ x ½-in. flats bent around the bolts; at the middle point they were stayed by 2 x 4-in. notched spacers wedged against the inside of the forms. By the time the concrete had reached these spaces the bolts were so firmly held by the concrete (and the bolt frame) that the spacing pieces could be removed and concreting completed to the finished grade. It was found to be worth while to attach a chain to the wedge and iron hangers to the spacing pieces, as shown, so as to permit their ready withdrawal, rather than to waste the time of the entire gang while a laborer fished out the wedges, etc., which operation, owing to the confined space, caused exasperating delays in the beginning.

Hoisting Engines Used to Help Trucks on Seventeen Per Cent. Grade

HAULING of excavated material from the deep cut which is being widened to give railway connection to the South Brooklyn Army supply base was accomplished by means of motor trucks helped by auxiliary hoisting engines. The grade was upward of 17 per cent., and was planked, as shown in the accompanying illustration.

That the trucks might not be delayed, two 9 x 12 hoisting engines were placed at the top of the grade, one on each side. While a truck is coming up on one side, another is going down on the other. Letting the trucks down by cable was not absolutely necessary, but was considered safe and acted as a means for taking the cable down to bring up the next load.

To center the cables on the roadway a deadman consisting of a large steel I-beam, securely embedded in the ground, was placed in the center and just beyond the brow of the hill. To this two large pulleys were attached, and the lines from the engines passed through these and thence down the grade. By this means trucks carrying about four cubic yards of material were easily operated.

This work is under the supervision of the Construction Division of the Army. Brig. Gen. R. C. Marshall, Jr., is chief of the Construction Division, Lieut. Col. H. S. Crocker is constructing quartermaster, and Maj. J. W. Cerny, Quartermaster Corps, National Army, assisted by Capt. L. A. Sumner, is directly in charge of the work described. The general contractor is the Turner Construction Co. of New York City, of which A. C. Tozzer is executive manager, and the subcontractor for the hauling is Rodgers & Haggerty, of New York.

TRUCK BEING HAULED UP STEEP GRADE—NOTE CABLE ATTACHED

NEWS OF THE WEEK

New York, March 20, 1919

Passaic Valley Sewage Disposal Suit Reopened

A reopening of the suit brought by the city of New York against the Passaic Valley Sewerage Commission (nominally the State of New York against the State of New Jersey) has been ordered by the United States Supreme Court. The suit was originally brought in October, 1908, to prevent the alleged pollution of the waters of New York Bay by the treated sewage of Newark and other communities included in the Passaic Valley Sewerage District. Testimony was taken from June, 1911, to June, 1913, but the case was not argued until late in 1918.

The court holds that supplementary evidence is needed. It permits the defendants to take the testimony of not more than three "sanitary or engineering experts" on (1) "any practicable modification of the proposed system of sewage treatment" that would lessen the alleged pollution, and (2) on "any practicable plan of sewage disposal or treatment" applicable to New York City sewage that would lessen the pollution of the harbor. In addition (3) both parties are authorized to take evidence on the degree of pollution of the harbor. The evidence in behalf of the defendants must be in by Aug. 15, 1919. Between then and Sept. 15 the defendants may, if desired, recall in rebuttal the experts who have testified under (1) and (2) and may also offer rebuttal evidence under (3).

After the new evidence is all in, a date for further argument will be set. The evidence will be taken by James D. Maher, clerk of the United States Supreme Court, sitting as a commissioner in New York and Newark. Mr. Maher took the earlier evidence in this case.

Engineering Regiment Cited

For conspicuous gallantry in action on the last night of the war, the Second Engineers were cited in the orders of Maj. Gen. J. A. Lejeune, commanding the Second Division. The citation reads as follows:

1. On the night of Nov. 10, heroic deeds were done by heroic men. In the face of heavy artillery and withering machine-gun fire, the Second Engineers threw two foot-bridges across the Meuse, and the first and second battalions of the Fifth Marines crossed resolutely and unflinchingly to the east bank and carried out their mission.

2. In the last battle of the war, as in all others in which this division has participated, it enforced its will on the enemy.

Employment

For the convenience of engineers returning from military life, and others, there are listed below agencies which may be helpful to those who are seeking employment:

Professional and Special Section, United States Employment Service:
16 East 42nd St., New York.
63 E. Adams St., Chicago.
1518 Walnut St., Philadelphia.
16 Tremont St., Boston.

N.B. Official information has been received that all offices of the Professional and Special Section of the United States Employment Service will close Mar. 22, unless they can be temporarily continued by local interests. This action is made necessary by the failure of Congress to appropriate funds.

Engineering Societies Employment Bureau; Walter V. Brown, secretary, 29 West 39th St., New York City.

American Association of Engineers, F. H. Myers, manager, 29 So. La Salle St., Chicago. Service to members only, but Army or Navy engineers in uniform who are eligible to certified membership may join without payment of entrance fees or dues while in uniform and for six months after discharge.

Engineers' Service Bureau, maintained by the Joint Council of Engineering Societies of San Francisco, care of B. P. Legare, Engineers' Club, 57 Post St., San Francisco. Only applications by mail or wire will be considered.

Joint Influenza Committee

The Surgeon Generals of the Army, the Navy and the United States Public Health Service, and the Director of the Census, have created a joint committee to study and compare the influenza data of the various Government departments. The members are: Dr. William H. Davis, chairman, and C. S. Sloane, representing the Bureau of the Census; Dr. Wade H. Frost and Edgar Sydenstricker, of the Public Health Service; Col. D. C. Howard, Col. F. F. Russell and Lieut. Col. A. G. Love, U. S. A.; Lieut. Commander J. R. Phelps and Surgeon Carroll Fox, U. S. Navy.

United States Employment Service Greatly Curtailed

Failure of Congress to pass the Urgent Deficiency Bill in the last days of the session has made it necessary for Secretary Wilson of the Department of Labor to curtail by 80% the United States Employment Service to returning soldiers. It was hoped that this deficiency might be overcome by drawing on President Wilson's war emergency fund, but this has been exhausted.

It is proposed to save a skeleton by retaining a 20% organization, around which various other Government agencies, welfare organizations, etc., will be centralized to carry on the work. In doing this, the 56 regular branch offices which remain of the 750 which had been established will be located in the strategic industrial centers.

Unemployment, as indicated by reports of cities to the Department of Labor, is increasing from week to week, and this curtailment of the Employment Service is considered unfortunate. It is hoped that local communities will continue the Government work.

Training Camps Association Takes Over Employment Work

Left without funds, the Professional and Special Section of the United States Employment Service in Chicago has turned over to the Military Training Camps Association a restricted portion of its work. The association proposes to handle applications from men returning from service only. This means much to engineers, for there are approximately 500 applicants in the Federal files. The Chicago office under the new organization, with W. R. Robinson as its head, has just begun to function, having placed 26 men, exclusive of teachers, during the week which ended Mar. 15. D. A. Tomlinson, who became the head of the office Mar. 15, Mr. Robinson having gone with the Curtis Publishing Co., will remain with the service only until the shift has been effected.

The Military Training Camps Association is located at 220 So. State St., and has a strong national organization maintained by membership fees and contributions. It has the military backing of General Wood, who was recently transferred to Chicago in command of the Central Department of the Army, and has interested himself in the employment situation. For the purpose of continuity of service the association has placed the nucleus of the Federal bureau's staff on its payroll.

Government Surplus Lumber For Sale

The Director of Sales of the War Department has executed a contract with J. L. Phillips and John Stephens, of Jacksonville, Fla., the representatives of the lumber producers, for all of the surplus lumber in the War Department on projects where there is any considerable quantity to be disposed of.

Messrs. Phillips and Stephens can be reached at 708 13th St., N. W., Washington, D. C., and will receive any offers on lumber which they have for sale for the War Department. They have purchased this lumber and agree to resell it at the market price for the various species and grades of lumber, paying to the War Department the amount received for this lumber, less the actual expense of selling; and, in addition, they agree to clean up the entire surplus lumber within the coming six months.

The quantity covered under the contract with the department was 188,000,000 ft., and additional quantities in sight from the department and the Housing Corporation made the amount over 200,000,000 ft. The department has now withdrawn from the contract all the lumber at all the camps and from some storage points, the amount aggregating approximately 160,000,000 ft. This lumber will not be sold. This will leave only between 30,000,000 ft. and 40,000,000 ft. located at widely scattered points and of a variety of sizes, species and grades.

Water-Main Extension Problems Feature of Meeting

Following a short lantern-slide talk on the recent break in a 1200-hp. turbine at the Wachuset dam, by William E. Foss, chief engineer of the Metropolitan Water-Works (as mentioned in *Engineering News-Record* of Feb. 20, 1919, p. 403) the New England Water-Works Association at Boston devoted the rest of its time, after the monthly luncheon on Mar. 12, to a discussion of meeting the cost of water-main extensions. The first speaker, M. N. Baker, of the editorial staff of *Engineering News-Record*, suggested wider use of the assessment-for-benefits plan, especially in view of the fact that the war and prohibition have joined hands in making more difficult than ever the problem of financing municipal improvements.

Coupled with Mr. Baker on the program was C. M. Saville, chief engineer and manager of the Hartford water-works. In Hartford, property owners now guarantee a yearly revenue of 10% for 10 years on the cost of a main large enough to supply the street. C. E. Davis stated that in Philadelphia property is assessed $1 a front foot for main extensions. The assessment is a lien on the property. With a prospect of diminishing revenues due to prohibition, it has been proposed that there be levied an assessment for the high-pressure fire system, based on the cubic space in the buildings projected.

A. R. Hathaway of Springfield, Mass., said that in his city property owners may divide the charge for a water main extension among themselves as they see fit. Leonard Metcalf of Boston approved the general plan of assessment for benefit, which he thought is more common than generally supposed. In the West, where lots are large and much of the city area is sparsely settled, there is a strong argument for the plan. F. P. Stearns thought that the assessment plan would discourage applications for extensions.

Alaskan Railroad Work Curtailed

Owing to the failure of Congress to provide necessary funds, it is probable that work on the Alaskan Government railroads will have to be materially curtailed. The construction work under way even may be reduced, and certainly no new work will be undertaken unless an extra session of Congress should make the needed funds available.

Illinois Has Waterway Project

A new plan for a waterway to form a link in the Lakes and Gulf waterway by connecting the Chicago Drainage Canal with the Illinois River at La Salle, Ill., is contained in a bill submitted to the state legislature. It has the backing of Governor Lowden, and was prepared by the State Department of Public Works and Buildings. The channel will have a bottom width of 150 ft., with a water depth of 8 ft. in earth sections, 10 ft. in rock and 14 ft. over lock sills. Locks 110 x 600 ft. long are provided, enabling fleets with 5000 to 7000 tons of freight to be accommodated. The cost is estimated to come within the bond issue of $20,000,000 which has already been authorized by public vote. When the bill is passed the project will be submitted to the War Department, and it is hoped that approval will be given in time to permit of starting work this season.

Outlook for Highway Improvements in California

Several county bond issues are to be voted on, and several others are proposed, in California, according to reports. A $40,000,000 bond issue is also being contemplated for the state at large.

Among the counties, Fresno will vote on $4,600,000 on May 6, while Sonoma will vote on $1,600,000 on May 27. Marin County has requested a Government engineer to prepare highway plans, and five northern counties have requested an engineer to lay out an intercounty system for them.

In addressing the State Road Supervisors' Association, Governor Stephens stated that the state-wide bond issue mentioned above is about to be proposed, and requested their united support. This was given in the form of a resolution which was passed by a large majority.

Ontario Good Roads Association Meets in Toronto

Great interest in the subject of good roads was shown at the 18th annual convention of the Ontario Good Roads Association, held in Toronto, Mar. 5-7, when 300 delegates met to discuss the road problems of the province. Public work to tide over the labor shortage of the reconstruction period, together with changes in the laws affecting labor upon the roads, was the principal topic of the speakers.

What is known as "statute labor," or working out the road tax, received the greatest amount of discussion at the convention. It was the sense of the meeting, as expressed in a resolution carried by a fair majority, that this form of road administration should be discontinued, and that the road construction of counties should be put under a competent surveyor.

A great increase in motor traffic, as evidenced by the advance in receipts from licenses from $950,000 in 1917 to $1,200,000 in 1918, makes it necessary, according to the Hon. George S. Henry, minister of agriculture, to put the township roads of the present system into such condition that they can be used all the year round.

The following officers were elected for the ensuing year:

President, K. W. McKay, St. Thomas; first vice-president, J. J. Parsons; second vice-president, W. H. Pugsley, Richmond Hill; third vice-president, Capt. Lucius E. Allen, Belleville; secretary-treasurer, the Hon. George S. Henry, member of the provincial Parliament; assistant secretary-treasurer, Maj. T. L. Kennedy.

Federal Highway Council To Hold First Meeting in Chicago

The first meeting of the newly organized Federal Highway Council, described in *Engineering News-Record* of Feb. 6, 1919, p. 303, will be held at the Congress Hotel, Chicago, Apr. 7-8. The meeting will open with an informal "get-together" dinner on Monday evening, Apr. 7.

Representatives of 38 state highway departments, together with 190 prominent men representing civic organizations throughout the entire country, have accepted membership in the council and are expected to be in attendance. Indorsement by many organizations of the national highway policy and plan outlined at the Chicago Highway Congress by E. J. Mehren, editor of *Engineering News-Record*, indicates the interest in highway work throughout the country and suggests a wide field of action for the Federal Highway Council.

Road-Bond Issue Submitted to Vote by Legislature

Another state was added to those which have submitted large highway bond issues to a vote of the people, when the Governor of Washington signed a bill passed by the legislature

providing for a referendum on an issue of $30,000,000. The measure will be voted upon at the general election in 1920 and, if it is carried, the funds will be used to build hard-surfaced roads throughout the state. A bill providing for county superintendents of highways reporting directly to the State Highway Commission, reported in *Engineering News-Record* of Feb. 13, 1919, p. 351, was defeated.

Interior Department Obtains High Explosives for Road Work

High explosives worth $10,000,000 and consisting largely of TNT have been turned over by the War Department to the Department of the Interior for reconstruction purposes. It is reported that Secretary Lane, of the Interior Department, plans to use much of this material for blasting on road-building projects.

Federal-Aid Highway Appropriation Goes Through

Federal aid for highways received a large addition when the Postoffice appropriation bill went through the Senate carrying $200,000,000 for this purpose. The bill, which was noted in *Engineering News-Record* of Jan. 30, 1919, p. 251, now awaits the signature of the President.

The provisions of the bill greatly enlarge the scope of the term "rural post road," to cover roads that either are used or can be used for transportation of the mails. It also increases the maximum payments which the Federal Government can make per mile from the previous amount, $10,000, to $20,000. This will allow the building in coöperation with the states of roads costing $40,000 per mile.

Canada Takes Over Grand Trunk Pacific

The Grand Trunk Pacific Ry. has been taken over by the Canadian government, which assumed control at midnight Mar. 9. The Hon. J. D. Reid, minister of railways, was appointed receiver. This action was caused by an official notification received by Sir Thomas White, acting premier, from the vice president of the railway, that, in view of the fact that the increased rates have not been sufficient to meet the increased operating expenses, it would not be possible for the company, owing to lack of funds, to continue its operations beyond Mar. 10. The War Measures Act was held to provide adequate authority for immediate action by the Government to prevent interruptions in the operation and management of the system.

W. P. Hinton, the general manager, has agreed to conform to the requirements of the Government and to facilitate the carrying out of the powers and duties required by the minister of railways as receiver. The acquisition of the road adds 1964 miles of main road and about 1000 miles of branch line to the Government system.

Oklahoma Society Considers Paving Brick and Concrete Tanks

Influenza compelled the postponement of the annual meeting of the Oklahoma Society of Engineers in October last, and the deferred meeting was held in Oklahoma City, Mar. 6. Trouble with reinforced-concrete tanks was described by R. E. Brownell, district engineer of the Portland Cement Association, and the discussion indicated a general opinion that tanks 12 to 30 ft. high, made with 1:2:4 concrete, should be waterproof if properly built. Mr. Brownell pointed out that to produce strong concrete the water must be measured as carefully as the other materials.

Officers of the society for the short term of 1919 were elected as follows: President, T. P. Clonts, county engineer, Muskogee; vice-presidents, Col. Frank B. King, R. E. Brownell and D. W. Patton; secretary, H. V. Hinckley, Omaha City, Okla.

Civil Service Examinations

For United States Civil Service examinations listed below, apply to United States Civil Service Commission, Washington, D. C., or to any local office of commission, for form 1312.

United States.—Superintendents of road construction, Bureau of Public Roads, Department of Agriculture, Mar. 25: Class A (candidates with four years' responsible charge of construction) $150 to $175 per month: Class B (six years' responsible charge) $185 to $225; Class C (eight years' responsible charge) $230 to $250 a month. File applications before Mar. 25.

United States.—Assistant examiner, Patent Office, Washington, Mar. 26-28, and May 21-23 and July 23-25. Pay, $1500 per year. File applications in time to arrange for examinations at place selected by applicant.

United States.—Chief physicist, qualified in aëronautics, National Advisory Committee for Aëronautics, Langley Field, Hampton, Va., Mar. 25, $3000 per year. Also physicist, $2100 per year. File applications before Mar. 25.

United States.—Senior highway bridge engineers, Apr. 1, Bureau of Public Roads, Department of Agriculture, Washington, D. C. Grade 1 (examination percentage above 70) $2400 to $2700 per year; Grade 2 (percentage above 80) $2800 to $3000 per year; Grade 3 (percentage above 90) $3100 to $3400 per year. File application before Apr. 1.

United States.—Engineer-draftsman, Apr. 22, $1500 to $1800 per year. File application before Apr. 22.

United States.—Transitman, $100 to $125 per month, and surveyor, $125 to $200 per month, Mar. 26-27 and Apr. 23-24. File applications in time to arrange for examination at place selected by applicant.

United States.—Aëronautical engineering draftsman, National Advisory Committee for Aëronautics, Apr. 1, $1500 per year. File applications before Apr. 1.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

NATIONAL FIRE PROTECTION ASSOCIATION; 87 Milk St., Boston, Mass.; May 6-8, Ottawa, Can.

AMERICAN ASSOCIATION OF ENGINEERS, 29 S. LaSalle St., Chicago; May 13-14, Chicago.

The Niagara Peninsula Branch of the Engineering Institute of Canada was formed at a meeting at Niagara Falls, Ont., Mar. 11, attended by members of the Engineering Institute of Canada and other engineers resident in the Niagara district. Frazer S. Keith, general secretary, explained the scope and functions of the Engineering Institute to a large gathering of representatives from St. Catharines, Thorold and Niagara Falls. Visiting engineers were present from New York City, Philadelphia and from the Hamilton branch. The following officers were elected: Chairman, A. C. D. Blanchard, Niagara Falls, Ont.; vice-chairman, W. P. Near, St. Catharines, Ont., and secretary-treasurer, R. P. Johnson, Niagara Falls, Ont.

The Society of Polish Engineers and Business Men in America, with headquarters in the Engineering Societies Building, 29 West 39th St., New York City, has been organized to work in conjunction with the Commercial and Industrial Bureau of the Polish National Department, 33 West 42nd St. The organization is headed by Ralph Modjeski, as honorary president. Steven de Csesznak, publisher of *Export American Industries*, is president.

The Iowa Section of the American Water-Works Association will hold its fourth annual meeting at the State University of Iowa, Iowa City, Apr. 16-17. Preliminary plans for the meeting indicate that a prominent place will be given to the reconstruction and extension problems of water-works under existing abnormal conditions.

The Engineers' Society of St. Paul held its regular monthly meeting Mar. 10. A motion picture, "From Ore to Finish 'National' Pipe," produced by the National Tube Co. of Chicago, was shown. The society was recently represented by a committee which addressed the appropriations committee of the state legislature on the neces-

sity of having an appropriation to continue the topographic mapping of the state, and hydrographic surveys, in conjunction with the United States Geological Survey. The committee representing the society was composed of E. V. Willard, state drainage engineer; G. O. House, general manager of the Northern States Power Co.; L. P. Wolff, consulting engineer, St. Paul, and E. C. Dugan, of the United States Engineer's office, St. Paul.

The **Bankhead National Highway Association** will hold its third annual meeting at Mineral Wells, Tex., Apr. 18-19. Delegates from all the states along the line of the Bankhead Highway, from Virginia to California, are expected to attend. The United States Good Roads Association, of which Senator Bankhead is president, will also meet during the same week at Mineral Wells, beginning on Apr. 14. There will be an exhibit of machinery and materials. J. A. Roundtree, Birmingham, Ala., is secretary of the Bankhead National Highway Association.

The American Association of Engineers will hold a meeting in Chicago, Mar. 21, at which W. E. Skinner will speak on the proposed $10,000,000 soldiers' memorial building.

The Engineers' Club of Philadelphia will be addressed by Joseph A. Steinmetz on "News from the Peace Zone," at the weekly luncheon Mar. 25.

The Technology Club of Syracuse, N. Y., was addressed Mar. 17 by Henry C. Allen, city engineer, on "The Water Supply of Syracuse." On Mar. 24 C. E. Drayer, secretary of the American Association of Engineers, will speak on the work of the association.

The Quincy, Ill., Engineers' Society elected the following officers at the recent annual meeting: President, W. F. Gerdes; vice-president, W. C. Dowd; secretary-treasurer, Dwight P. Child. A paper on street paving, by Webster P. Bushnell, was presented.

The Montreal Branch of the Engineering Institute of Canada will be addressed Mar. 27 by R. de L. French, who will read a paper entitled "Some Notes on the Design and Construction of Reinforced-Concrete Covered Reservoirs."

The Southern California Association of Members of the American Society of Civil Engineers has planned a series of discussions on flood control in southern California. The regular meetings of the association have been changed from bimonthly to monthly. After the first topic has been covered, other "local engineering problems of vital consequence to the community" will be considered along professional lines. At the first meeting, which was held on Mar. 12, there was an introduction of the flood-control subject by George G. Anderson, a historical sketch by F. H. Olmsted, and a talk on the physiography involved, by A. L. Sonderegger.

The New England Water-Works Association will hold its next annual meeting in Albany. The time will probably be the second week in September.

The Duluth Engineers' Club held its monthly meeting Mar. 15, at which the committee on local transit reported on Duluth street-railway conditions with respect to factors attending impairment of the service last winter.

The Engineers' Club of Seattle, at a recent meeting, was addressed by Maj. William F. Allison, who spoke on "The Work of the Sanitary Engineers with the American Army in France."

The Engineers' Club of Minneapolis was addressed Mar. 17 by Professor Comstock of the Minnesota State University of Mines, who spoke on "The Mining Industry of Minnesota."

PERSONAL NOTES

COL. F. A. MOLITOR, Twenty-Second Engineers, has been discharged from the Army and has returned to New York to resume his consulting practice. The Twenty-Second Engineers, which Colonel Molitor commanded, was assigned to the construction of light railways. In November Colonel Molitor was detailed from his regiment and placed in charge of engineer supplies.

ROY MULLINS, division highway engineer of New Jersey at Trenton, has been appointed division engineer in charge of the northern division, with headquarters at Newark, succeeding E. M. Vail, who has been put in charge of the new department of maintenance, as noted elsewhere.

MAJ. I. S. OSBORN, Quartermaster Corps, U. S. A., has been discharged from the service and has returned to engineering practice with the Allen-Osborn Co., engineers and architects, of Cleveland, Ohio. At the request of Herbert C. Hoover, he organized the Garbage Utilization Division, United States Food Administration, later resigning to enter the Army to organize the Reclamation Division in the Quartermaster Corps, of which he was chief during the first part of 1918. During the latter part of the year he was assigned to special duties and inspection work in connection with the Salvage Division, Office of the Director of Purchase, Storage and Traffic.

HENRY E. ELROD, DAVID DRENNAN and FRANK S. TAYLOR, formerly of the engineer firm of Lyndon, Taylor & Perrilliat, New York City and New Orleans, have become associated under the firm name of the Henry Exall Elrod Co., Dallas, Tex., consulting engineers, successors to Henry Exall Elrod. The new organization will continue to specialize in municipal work, utility valuation and regulation, and highway engineering.

H. A. SCHAFFER, previously of the firm of Harrison & Schaffer, consulting engineers and chemists, Easton, Penn., has joined the staff of the Portland Cement Association as chemical engineer to conduct conservation studies. From October, 1918, he was acting as advisory chemist and assistant to the Director of Building Materials, War Industries Board, Washington.

MAJ. W. A. WELCH, Air Service Aircraft Production, U. S. A., division engineer, Spruce Production Division, and chief engineer, Spruce Production Corporation, has been discharged from the service and has returned to his former position as chief engineer of the Palisades Interstate Park Commission.

MILO S. KETCHUM, assistant director of the United States Government explosives plant, who since February, 1918, has been in charge of the construction of the smokeless-powder plant at Nitro, W. Va., has returned to the University of Colorado to resume his duties as dean of the College of Engineering and professor of civil engineering.

CAPT. A. U. WETHERBEE, Chemical Warfare Division, U. S. A., who was formerly chief engineer and assistant works manager of the Niagara Alkali Co., recently received his discharge from the service and has become chief mechanical engineer, Powdered Coal Engineering & Equipment Co., Chicago.

LIEUT. C. F. URBUTT, Construction Division, U. S. A., has received his discharge from the service and has been appointed district engineer, Chicago, Milwaukee & St. Paul R.R., with office in Chicago, succeeding W. L. Webb, assigned to special work in connection with the Chicago Union Station, as noted elsewhere.

ARTHUR H. BLANCHARD, consulting highway engineer, New York City, has been appointed chief of the Bureau of Public Works, Department of Citizenship, under the Army Overseas Educational Commission of the Y. M. C. A. General Pershing has requested the Y. M. C. A., through its commission, to take charge of the development of instruction and courses for all educational work of the Army overseas. The staff of the Bureau of

Public Works and Army instructors, in 500 post schools throughout France, will give lectures and courses relative to waterways, railways, highways, bridges, water-supply, sewerage, waste disposal, public utilities, and irrigation.

LIEUT. WILLIAM H. HOBBS, 332nd Field Artillery, American Expeditionary Forces, has received his discharge from the Army and resumed his work as assistant engineer, Louisiana Division, Missouri Pacific R.R., with headquarters at Monroe, La.

H. W. SKIDMORE, construction engineer, Department of Public Works, Village of Oak Park, Ill., on Apr. 1 will become associated with Lester Kirschbraun, consulting and testing engineer of Chicago, and will become associate director of the Chicago Paving Laboratory, devoting practically all of his time to the paving field.

LIEUT. G. D. SHANNON, Ordnance Department, U. S. A., formerly highway division engineer, Vermilion County, Illinois, has received his discharge from the service and has become highway engineer of the Joplin, Mo., road district, in charge of construction.

LIEUT. WILLIAM F. BROCK, Engineers, U. S. A., stationed at Camp A. A. Humphreys, Virginia, has received his discharge from the service and has returned to his work with the Interstate Commerce Commission, Division of Valuation. He is at present located at Newbery, Fla.

L. P. SCOTT, assistant engineer, Road Department, Office of the Constructing Quartermaster, Camp Henry Knox, Kentucky, since his discharge from the service, has become constructing engineer on highway work for Sedgwick County, Kansas, with headquarters at Wichita.

U. S. MARSHALL, senior highway engineer, Bureau of Public Roads, who has just completed the paving work at Camp Lewis, Washington, has been transferred to Missoula, Mont., in charge of Federal road work in the state, succeeding J. S. Bright, transferred to District No. 3, Denver, as noted elsewhere in this issue.

E. M. VAIL, division state highway engineer in charge of the northern division, New Jersey, with headquarters in Newark, has been promoted to head the new department of maintenance.

COL. WILLIAM D. WRIGHTSON, chief of the Sanitary Corps, U. S. A., has received his discharge from the service and has resumed his connection with the International Health Board of the Rockefeller Foundation as sanitary engineer and member of the yellow fever commission. He will sail this month for South America, in company with Maj. Gen. William C. Gorgas, chairman of the commission, and Brig. Gen. Theodore C. Lyster, member of the commission, to investigate yellow fever conditions in Central and South America.

COMFORT AVERY ADAMS, previously professor of electrical engineering and Lawrence professor of engineering, Harvard University and Massachusetts Institute of Technology, has been appointed dean of the School of Engineering at Harvard.

CAPT. ALLAN V. ELSTON, 314th Engineers, American Expeditionary Forces, has received his discharge from the service and has resumed private practice in the firm of Wood, Elston & Witten, consulting engineers, Tulsa, Okla.

JOHN FLYNN, JR., who recently completed his work as project and supervising engineer, United States Housing Corporation project, Watervliet, N. Y., has been appointed village engineer of Green Island, N. Y., for the ensuing year.

LIEUT. FRANK W. VARDEN, U. S. A., formerly with the Koppers Co., has been discharged from the service and has entered the technical department of the Barber Asphalt Paving Company.

O. H. FRICK, field engineer on valuation work, Chicago, Milwaukee & St. Paul R.R., has been appointed district engineer, middle district, with headquarters in Milwaukee.

G. H. BISHOP, previously with the United States Public Health Service, Montgomery, Ala., has become chief engineer for the Cement Products Co., manufacturer of "Sanisept" portable sewage-disposal systems.

J. S. BRIGHT, engineer in charge of the branch office of the Bureau of Public Roads at Missoula, Mont., has been appointed engineer in charge of District No. 3, with headquarters in Denver.

W. F. CRAWFORD and R. N. WHITTESEY have become associated under the firm name of Crawford & Whittesey, civil and consulting engineers, Sapulpa, Okla.

MAJ. JAY A. ROSSITER, formerly track elevation engineer, Chicago, and CAPT. C. C. SANER, assistant engineer, on the city engineer's staff, Chicago, announce the opening of a sales engineer's office in the Union National Bank Building, Houston, Tex. Major Rossiter and Captain Saner were connected with the 108th Engineers, formerly a Chicago National Guard regiment. The new firm, Rossiter & Saner, represent the following manufacturers: Page-Burton Boiler Co.; F. C. Austin; Yeomans Bros.; Williams-Wendt Co.; Austin Manufacturing Co.; Baylis Sanitary Supply Co.; Chicago Waste Co.; American Steam Conveyor Corporation; Boland Construction Co.; Municipal Supply Co.; Universal Engineering Co., and Typhoon Ventilating System.

W. L. WEBB, district engineer, Chicago, Milwaukee & St. Paul R.R., with headquarters in Chicago, has been assigned to special work in connection with the Chicago Union Station.

JOSEPH W. HUNTER, formerly state highway commissioner and since 1911 first deputy highway commissioner of the Pennsylvania State Highway Department, has been appointed township commissioner of the department.

LIEUT. ALLEN F. SHERZER, 301st Feld Artillery, American Expeditionary Forces, has resumed his work with the Kingsford Foundry & Machine Works, Oswego, N. Y., having received his discharge from the service.

ROBERT C. BERLIN,, PERRY W. SWERN, and FRANK A. RANDALL have become associated as the firm of Berlin, Swern & Randall, architects and engineers, 19 So. La Salle St., Chicago.

GEORGE H. BILES, second deputy highway commissioner of Pennsylvania for the past three years has been appointed assistant highway commissioner.

R. A. BOOTH has resigned as state highway commissioner of Oregon.

OBITUARY

LYNDEN B. SCHOEMAKER, for the past nine years engineer of distribution, Department of Water Supply, Brooklyn, N. Y., died in that city Mar. 10, at the age of 34. He was graduated from Princeton in 1906 and served as an instructor during the following year, afterward entering the service of New York City.

THOMAS FLETCHER OAKES, former president of the Northern Pacific R.R., died in Seattle Mar. 14 at the age of 76. He directed the construction of the road from Spokane to Seattle. In 1863 he entered the service of the Kansas Pacific Ry., from which he resigned as vice-president in 1879 to become general superintendent of the Kansas City, Fort Scott & Gulf R.R. He later served as vice-president and general manager of the Oregon Ry. & Navigation Co. In 1881 he became vice-president of the Northern Pacific, and served as president from 1888 to 1893, when he was appointed receiver for two years.

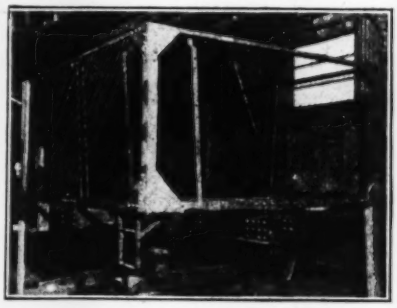
Concrete Freight Car Designed to Relieve Steel Shortage

A reinforced-concrete gondola car, having concrete sides, ends and floor with a steel skeleton body frame, and mounted on a steel underframe, was on exhibition in Chicago recently and represents a new development in the use of concrete. It was designed during the war as a means of relieving the shortage of steel and the demand for cars, but plans are being made for

FREIGHT CAR HAS CONCRETE SIDES AND FLOOR ON STEEL FRAME

manufacturing various types of concrete cars on a commercial scale.

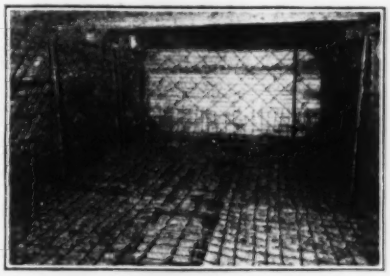
The car has a body 41 ft. long, 9 ft. 8 in. wide and 4 ft. 8 in. deep. It is designed for 50 tons load capacity plus 10% for overload. Unit stress was taken at 16,000 lb. in steel and 1000 lb.



STEEL FRAME AND REINFORCEMENT OF CONCRETE FREIGHT CAR

in concrete. Impact was computed at 25%. As the thickness of the concrete is only 2½ in., it was decided to use the cement gun for making the sides and floor, the cross-bearers being poured in the usual way. Forms were placed on the outside of the frame, and the concrete was shot from the interior. The density of the concrete applied in this way increased the weight, but it is estimated that cars of this size and design can be made weighing 23 to 24 tons. A new light-weight aggregate, known as haydite and invented by Stephen J. Hayde, of Kansas City, was used. This makes concrete said to weigh 104 lb. per cubic foot, with a compressive strength of 4450 lb. in 28-day tests.

The car was designed by J. B. Strauss and built by the R. F. Conway Co., while many parts of the equipment were contributed by the Illinois Central R.R. After 30 days' service on that road it will be turned over to the United States Railroad Administration. The



REINFORCEMENT FOR CONCRETE FLOOR, SIDES AND ENDS OF CAR

Concrete Car Co. has been organized by J. J. McCarthy, Joseph B. Strauss and F. E. Sullivan, of Chicago.

BUSINESS NOTES

The Sullivan Machinery Co., Chicago, announces the establishment of a branch office at Edificio Oliver No. 3, Mexico City, in charge of Joseph F. Bennett. The appointment of Chester Mott as manager of the Denver, Colo., office, succeeding Wallace T. Roberts, resigned, is also announced.

Twenty-one years' of service have brought G. W. Burrell to the assistant vice-presidency of the Wellman-Seaver-Morgan Co. He will have entire charge of the company's work, both at Cleveland and Akron.

The Chicago Pneumatic Tool Co. announces the removal of its Cleveland district office from Room 813 to Rooms 406-408 Engineers Building, effective Mar. 1. The new headquarters will serve the company's interests within the Cleveland district. Ross Watson is district manager.

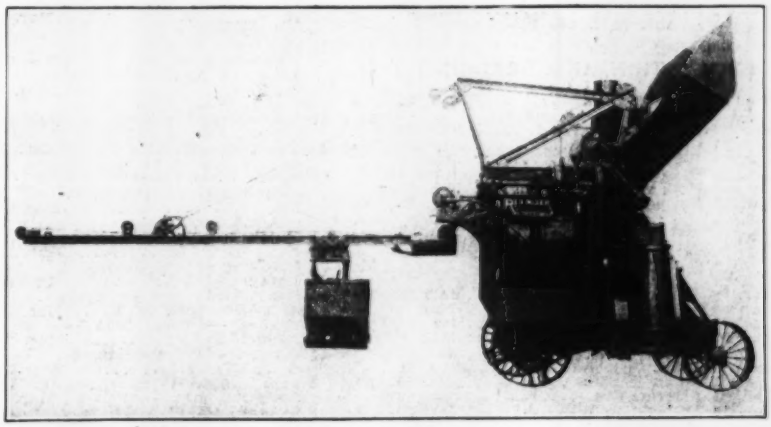
Turning from war to peace interests, the Associated Metal Lath Manufacturers have moved from Washington to their pre-war offices in the Swetland Bldg., Cleveland. During the war, Wharton Clay, who is the new commissioner, was connected with the Military Training Camps Association, in the work of placing men of special qualifications. The assistant commissioner is C. O. Powell, formerly with the Northwestern Expanded Metal Company.

Andrew Barr, who has been associated with the United States Wind Engine and Pump Co. since 1914, has accepted a position as superintendent of the foundry of the Waterloo Gasoline Engine Co., Waterloo, Iowa.

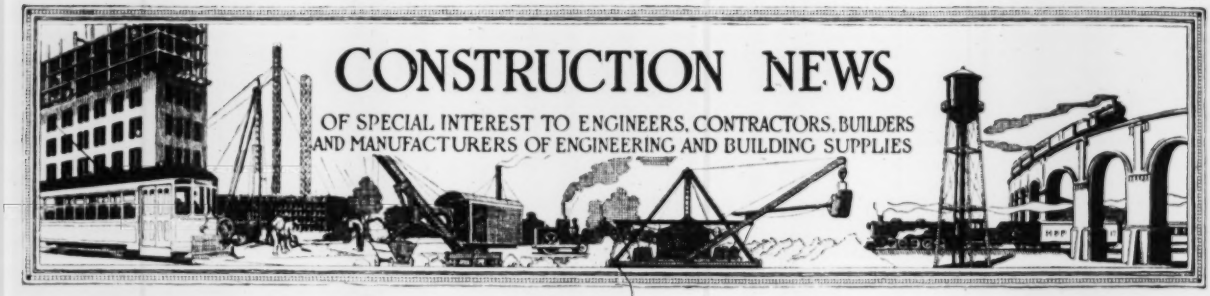
The Appraisal Engineering Co., Seattle, has opened offices at 409 Burke Bldg., as engineers and building contractors. Joseph Klein is superintendent.

New Paving Mixer Has Inclosed Transmission

A step toward automobile practice is marked in the concrete paving mixer field by the announcement of the 1919 model "Rex" 14-E, manufactured by the Chain Belt Co., of Milwaukee, shown in the cut. The sprocket chain drive is retained in the new model, which has rated forward speeds of 84 and 120 ft. per minute and a reverse speed of 90 ft. per minute. As suggested by its number, the machine has a wet concrete capacity of 14 cu.ft. It has a 90-in. loader, allowing the use of two wheelbarrows, and is equipped with either a 20-ft distributing boom or a 15-ft. spout, which receives the concrete at a height of 60 in. above the ground. The power plant is underslung, in order to lower the center of gravity. The overall width of the machine is 8½ ft., and the total height is 13 feet.



MIXER HAS INCLOSED TRANSMISSION GEARS SIMILAR TO AUTOMOBILE'S


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

PROPOSALS

For Proposals Advertised See Pages 63-69 inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Mar. 24	Minot, N. D.	Mar. 6
Mar 25	Jersey City, N. J. Adv. Feb. 27 and Mar. 13.	Feb. 20
Apr. 15	Duluth, Minn.	Mar. 13
Apr 16	Kansas City, Mo.	Mar. 20

SEWERS

Mar 24	Detroit, Mich.	Mar. 13
Mar. 24	New York, N. Y.	Mar. 20
Mar. 25	Youngstown, O.	Mar. 20
Mar 26	Brooklyn, N. Y.	Mar. 20
Mar 28	Chicago, Ill.	Mar. 20
Mar. 30	Hagerstown, Md. Adv. Mar. 20.	Mar. 20
Mar. 31	Central Falls (Pawtucket P. O.), R. I.	Mar. 20
Apr 1	Great Falls, Mont.	Mar. 20
Apr 1	Harrison, N. J.	Mar. 6
Apr. 1	Newark, N. J.	Mar. 6
Apr 2	Hamilton, Ont.	Mar. 13

BRIDGES

Mar. 22	Taylorville, Ill.	Mar. 20
Mar. 23	Buckhannon, W. Va.	Feb. 13
Mar. 24	Middlebourne, W. Va.	Mar. 6
Mar. 24	Roundup, Mont.	Mar. 20
Mar. 25	Jersey City, N. J.	Mar. 13
Mar. 27	Janeville, Wis. Adv. Mar. 6 to Mar. 20.	Mar. 6
Mar. 28	St. Remi, Que.	Mar. 20
Apr. 1	Peterborough, Ont.	Mar. 13
Apr. 1	Ft. Dodge, Ia.	Mar. 20
Apr. 7	Adna, Wash.	Mar. 20
Apr. 7	Rawlins, Va.	Mar. 20
Apr. 7	Stella, Va.	Mar. 20
Apr. 8	Lewisburg, W. Va. Adv. Mar. 13 and 20.	Mar. 20
Apr. 10	Clarksville, Pa.	Mar. 20
Apr 11	Holyoke, Mass. Adv. Mar. 13 and 20.	Mar. 13
Apr. 15	Copper Valley, Va.	Mar. 20
Apr. 16	Ottawa, Ont.	Feb. 20
Apr. 22	Kingston, N. Y. Adv. Mar. 20.	Mar. 20

EXCAVATION AND DREDGING

Mar. 26	Marion, Kan. Adv. Mar. 13 and 20.	Mar. 13
Mar 27	North Bergen, N. J.	Mar. 20
Mar. 31	Cleveland, O.	Mar. 20
Apr 4	Whiteside, Ill. Adv. Mar. 6 to 20.	Mar. 6
Apr 8	Hollandale, Miss.	Feb. 13
Apr. 10	Newport, Ark.	Mar. 13

INDUSTRIAL WORKS

Mar. 21	Newark, N. J.	Mar. 13
Mar. 25	Charleston, S. C.	Mar. 6
Mar 28	New York, N. Y.	Mar. 13
Mar. 31	Orillia, Ont.	Mar. 6
Apr 1	Quebec, Que.	Mar. 13
Apr 1	Sioux City, Ia.	Jan. 16
Apr. 1	Boonville, Mo.	Mar. 20
Apr. 1	Astoria, Ore.	Mar. 20
Apr. 18	Sheboygan, Wis.	Mar. 20

BUILDINGS

Mar. 23	Dayton, O.	Mar. 13
Mar. 24	Hawley, Minn.	Mar. 20
Mar. 25	Bath, N. Y.	Feb. 27
Mar. 28	West Unity, O.	Feb. 27
Mar. 31	Ottawa, Ont.	Mar. 6
Mar. 31	Edgard, La.	Mar. 13
Mar. 31	Charlotte, N. C.	Mar. 20
Mar. 31	Chicago, Ill.	Mar. 20
Apr. 2	Fairfield, Cal.	Mar. 20
Apr. 2	Lansing, Mich.	Mar. 6
Apr. 2	New York, N. Y.	Jan. 23
Apr. 2	Duluth, Minn.	Mar. 20
Apr. 2	Lansing, Mich.	Mar. 20
Apr. 4	Seattle, Wash.	Mar. 13
Apr. 7	Ordway, Colo.	Mar. 20
Apr. 10	Newaygo, Mich.	Feb. 6
Apr. 15	Newark, N. J.	Feb. 6
Apr. 22	Bovey, Minn.	Mar. 20
May 1	Wakefield, Minn.	Mar. 20

FEDERAL GOVERNMENT WORK

Mar. 24	Dredging — Wilmington, Del. Adv. Feb. 27 to Mar. 20.	Feb. 27
Mar. 24	Valve Operating Machinery —Wheeling, W. Va. Adv. Feb. 27 to Mar. 20.	Mar. 6
Mar. 24	Boatshead—Spec. 3472—Pensacola, Fla.	Mar. 6
Mar. 24	Fuel Oil Storage Plant—Spec. 3631—Mare Island (Valleyjo P. O.), Cal.	Mar. 13
Mar. 24	Cranes—Spec. 3822—Boston, Mass.	Mar. 13
Mar. 24	Forced and Induced Draft Fans—Spec. 3793—Norfolk, Va.	Mar. 13
Mar. 24	Incinerator—Spec. 3790—Indian Head, Md.	Mar. 13
Mar. 24	Extension to Fresh Water System—Spec. 3805—Pensacola, Fla.	Mar. 13
Mar. 24	Forced and Induced Draft Fans—Spec. 3793—Philadelphia, Pa.	Mar. 13
Mar. 24	Water Tanks—Spec. 3826—Newport, R. I.	Mar. 20
Mar. 24	Swimming Pools—Washington, D. C. Adv. Mar. 20.	Mar. 20
Mar. 25	Remodeling Post Office, etc. —Providence, R. I.	Feb. 27
Mar. 26	Drainage—St. Louis, Mo. Adv Feb. 27 to Mar. 20.	Mar. 6
Mar. 26	Post Office — Youngstown, O.	Mar. 13
Mar. 26	Alterations — Meridian, Miss.	Mar. 20
Mar. 26	Grading — Washington, D. C. Adv. Mar. 13.	Mar. 13
Mar. 27	Barracks — West Point, N. Y. Adv. Mar. 6 to Mar. 20.	Mar. 6
Mar. 27	Post Office and Custom House, Albany, N. Y.	Mar. 13
Mar. 29	Lock and Abutment-Greenup, Ky. Adv. Feb. 27 to Mar. 20.	Mar. 6
Mar. 31	Coal—Memphis, Tenn. Adv. Mar. 6 and Mar. 20.	Feb. 27
Mar. 31	Dredging—Wilmington, Del. Adv. Mar. 6 to Mar. 20.	Mar. 6
Mar. 31	Power Plant Improvements —Spec. 3389 — Pensacola, Fla. Adv. Mar. 13.	Mar. 13
Mar. 31	Boathouse—Spec. 3786—Newport, R. I.	Mar. 20
Mar. 31	Dredging—Spec. 3597—Ft. Lafayette, N. Y.	Mar. 20
Mar. 31	Quay Wall, etc. — Spec. 3726—Newport, R. I.	Mar. 20
Mar. 31	Cranes — Spec. 3794 — Alexandria, Va.	Mar. 20
Apr. 1	Cement—Conneaut Harbor, O.	Mar. 13
Apr. 2	Post Office—Honey Grove, Tex.	Mar. 6
Apr. 2	Sewer and Water Supply —Stapleton, N. Y.	Mar. 13
Apr. 4	Post Office—Eldorado, Kan.	Mar. 6
Apr. 4	Bear Trap Leaves—Cincinnati, O. Adv. Mar. 6 to Mar. 20.	Mar. 6
Apr. 5	Pass, Weir, etc. — Wheeling, W. Va. Adv. Mar. 13 and 20	Mar. 20
Apr. 7	Timber Wharf — Spec. 3801 —Chelsea, Mass.	Mar. 20
Apr. 7	Roads — Spec. 3796 — Chelsea, Mass.	Mar. 20
Apr. 15	Pumps, etc.—Omaha, Neb. Adv. Feb. 27 and Mar. 6	Mar. 6
Apr. 18	Post Office—Mt. Pleasant, Mich.	Mar. 13
Apr. 21	Post Office — Rhinelander, Wis.	Mar. 13
Apr. 23	Post Office—Gilmer, Tex.	Mar. 13

MISCELLANEOUS

Mar. 23	Structural Steel — New York, N. Y.	Mar. 20
Mar. 24	Gasoline and Kerosene — New York, N. Y.	Mar. 20
Mar. 25	Foundation — Philadelphia, Pa.	Mar. 13
Mar. 25	Air Compressor — Marion, Ind. Adv. Mar. 13 and 20.	Mar. 13
Mar. 25	Paving Material—Detroit, Mich.	Mar. 20
Mar. 25	Ballast—New York, N. Y.	Mar. 20
Mar. 26	Truck and Miscellaneous Supplies — Schenectady, N. Y.	Mar. 20
Mar. 27	Pier—Philadelphia, Pa. Adv. Mar. 13 and 20.	Mar. 13
Mar. 27	Rebuilding Crib Bulkhead —New York, N. Y.	Mar. 20
Mar. 31	Boardwalk—Seaside, N. J.	Mar. 13
Apr. 8	Road Materials—Columbus, O. Adv. Mar. 13 and 20.	Mar. 20

STREETS AND ROADS

Mar. 21	Rhode Island Adv. Mar. 13.	Mar. 13
Mar. 24	Rugby, N. D.	Mar. 6
Mar. 24	Stony Creek, Pa.	Mar. 20
Mar. 24	Grafton, N. D.	Mar. 20
Mar. 24	Beaumont, Tex.	Mar. 6
Mar. 24	New Haven, Conn.	Mar. 20
Mar. 24	New York, N. Y.	Mar. 20
Mar. 25	Buffalo, N. Y.	Mar. 20
Mar. 25	North Bergen, N. J.	Mar. 20
Mar. 25	Kearney, N. J.	Mar. 20
Mar. 25	New Essington, Pa.	Mar. 20
Mar. 25	Massachusetts	Mar. 20
Mar. 25	Salt Lake City, Utah	Mar. 20
Mar. 25	Bottineau, N. D.	Mar. 6
Mar. 25	Mt. Olive, N. C. Adv. Mar. 6 and 13.	Mar. 13
Mar. 25	Pillsburg, Pa.	Mar. 13
Mar. 25	Youngstown, O.	Mar. 20
Mar. 25	Wheaton, Minn.	Mar. 20
Mar. 26	Baltimore, Md.	Mar. 20
Mar. 26	Fairmont, W. Va. Adv. Mar. 6 to Mar. 20.	Mar. 6
Mar. 26	Delaware, N. J.	Mar. 6
Mar. 27	Danville, Ill.	Mar. 20
Mar. 27	Michigan	Mar. 13
Mar. 27	Devils Lake, N. D.	Mar. 6
Mar. 27	Center City, Minn.	Mar. 6
Mar. 27	New York, N. Y.	Mar. 13
Mar. 28	Wheaton, Ill.	Mar. 20
Mar. 28	Buffalo, N. Y.	Mar. 20
Mar. 28	New York, N. Y.	Mar. 20
Mar. 28	Toledo, O.	Mar. 20
Mar. 28	Ohio	Mar. 20
Mar. 28	Anoka, Minn.	Mar. 13
Mar. 28	Dayton, O.	Mar. 6
Mar. 28	Pennsylvania Adv. Mar. 6 to Mar. 20	Mar. 6
Mar. 31	Lockport, N. Y.	Feb. 6
Mar. 31	Ottawa, Ont.	Feb. 27
Mar. 31	Central Falls (Pawtucket P. O.), R. I.	Mar. 20
Mar. 31	Youngstown, O.	Mar. 20
Apr. 1	Raleigh, N. C.	Mar. 20
Apr. 1	Salt Lake City, Utah	Mar. 20
Apr. 1	Billings, Mont.	Mar. 20
Apr. 1	Kansas City, Mo.	Mar. 20
Apr. 2	Gold Beach, Ore.	Mar. 13
Apr. 2	Michigan	Mar. 13
Apr. 2	Santa Ana, Cal.	Mar. 13
Apr. 2	Boston, Mass.	Mar. 20
Apr. 2	Durham, N. C.	Mar. 20
Apr. 2	Bamberg, S. C.	Mar. 20